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DESIGN

A TREATISE ON THE DISCOVERY OF FORM

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DESIGN

A TREATISE ON THE DISCOVERY OF FORM

BY

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TWO OF MY MASTERS

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Part I

THE SCIENCES OF ART

I

INTRODUCTION

1. *The Intention*

THIS is not a text-book. It is intended to serve as a helpful sidelight for those who have occasion to read text-books in connexion with their studies of the arts. Those who have an interest in the arts of a more desultory kind, which, never impelling the reading of a text-book, yet encourages a certain inquisitiveness as to theory on artistic matters, may derive some satisfaction from a perusal.

Our literature has long been saturated with inconsistent assumptions on art and taste. Their inconsistency is due to their being for the most part derived indirectly and at haphazard from the philosophies of many periods. But artistic expression is as primordial as war—a natural phenomenon with unchanging laws. In both there is an evolutionary process ever at work as part of this law; technique changes but principles remain static.

It would be ridiculous to assert that the principles of artistic expression are now established beyond all doubt and cavil. It is not too much to say that, for twenty-five centuries and more, people have been thinking and writing about these principles; sometimes more and sometimes less and sometimes not at all, but on the whole with continuity. There has thus been an evolution of statement on the principles of art. Now, if all the authors of treatises on art had been content to ignore all that had been written on the subject before their time and to devote themselves whole-heartedly to writing about works of art, there would be little temptation to undertake these labours. Or, again, if all these authors had been conversant only with the philosophies of their own day, as a result of appropriate arrangements for the destruction of all but current books on art, as Croce recommends, this book would be superfluous.

But things are far otherwise, and the broad result has been the erection of a prickly barrier between the artist and his public and innumerable cleavages among the artists. In spite of these cleavages, it is safe to say that artists understand pretty well what other artists would be at; but the reading public, the world over, is tainted with the residual waste products of an indigestible diet of snippets from the aesthetic of all the ages.

It is hoped that what is written herein may reduce this barrier; God forbid that it should have the effect of raising it still higher. Art critics are sometimes interested to know what an artist has to say about his own and other arts. If such an one should chance to honour these pages, it is desired that he will bear this aspiration in mind.

2. *Instruction in Design*

The general incentive to writing this book has arisen from thirty years of what is called 'teaching design' in a school of architecture. Design, of course, cannot be taught. All that an architect in charge of the design done in a school can do is to encourage an orderly mental process in the solution of problems, and, when a student is found with something to say in the hypothetical building material of imaginary structure, to help him say it grammatically. Now to one engaged in such quasi-pedagogic activities there are two lines of procedure open. He may give his advice with all the authority of an emotional assurance, based upon his own taste, on established precedent, and on general usage; or he may give his advice, with first principles always at the back of his mind and ready to hand. In the latter case he will learn as much from his students as they will from him.

Which is the better method must depend largely on the student. I have been fortunate in having a succession of students afflicted with few preconceived ideas and blessed with avid inquiring minds. Their independence has been their most lovable trait. They have looked me in the eye and said 'Why?' and I have realized the futility of any reply implying 'to make it more beautiful'. From motives of economy of time, lectures have been inflicted upon them. They were entitled to know my point of view and how it was arrived at. Never have I sought to impose this point of view; they have been encouraged to form their own, provided they assembled the points at issue and sought to reconcile them systematically. Some of these independent efforts have been very helpful to me; many of my students have flatteringly accepted my views as a working hypothesis; a few have embarrassed me by accepting them as a creed. Thirty years of close contact with young minds encourages the hope that what is here set down may be helpful to other students, always provided they will do their own thinking and accept nothing on the writer's mere 'say so'. They may then find themselves in a better position to derive real profit from the literature of art, having some means of discounting the commoner fallacies that peep so persistently from its pages.

3. *The Structure of the Book*

The crabbed style of Vitruvius has often been commented on. He was by profession a writer of specifications and contracts. I am very conscious of like deficiencies and from a like cause. The best one can hope is to avoid 'as per' and 'see drawing N°. . . .' in the consciousness that these are not elegancies of the English language. Some effort has been made to reduce to a minimum the use of the uncrystallized jargon of psychology and the graceless dialect of building technology. The twenty-eight chapters are made up from notes for a course of fifty lectures. Lapses into pedagogic dogmatism must therefore be expected. It is, however, in a spirit of inquiry that the work is undertaken.

As originally conceived before the war, this was to have been a book on architecture. There have been times when the writer was not sure that such a thing as architecture existed. It is now become a book on engineering for the most part. It is not until the reader reaches the chapters in the fourth part that any serious attempt is made to distinguish where engineering ends and architecture begins. The third part is devoted to the mental process of solving problems of design. For the most part problems of planning for buildings are made use of in this connexion. The technology which is introduced is only incidental to the main purpose, which is a demonstration of the fact that the design of buildings is primarily an application of engineering method to a particular class of problems. In the second part there is discussion of scale, proportion, and refinements, as the raw material of artistry in the design of the apparatus of life; and also of ornamentation, as an activity quite distinct from pure design—the discovery of form in terms of purpose, material, and technique. The chapters in the first part of the book deal with the philosophy of the arts, among which DESIGN has its place only when it concerns itself with certain matters over and above the mere solution of problems; and also with the sciences of colour and form vision which underlie the application of hedonic elements in visual expression.

In thus reviewing the structure of the book backwards, it becomes apparent that its chapters might have appeared in reverse order. The statement of general theory in the second chapter is in reality the result of a long experience in dealing with the ordinary problems of design that arise in practice, when carried on in the spirit set forth in the later chapters. It has been thought more convenient to argue, as it were, from the general to the particular, adducing the particular as circumstantial proof of the main thesis. It is as an attempt to relate to a comprehensive theory of expression what the designer in any field actually does, and must do, that this book may have a value.

4. *The Limitations*

As has been said, these twenty-eight chapters make no claim to constitute a text-book. They do not deal exhaustively with any of the many aspects of design touched upon within their confines. The substance does not cover all that a designer should know as to the place of his work in the scheme of life and things. It covers, cursorily, certain matters the designer should know far more about than is herein set forth. In these pages little more is attempted than a fairly comprehensive list of these matters, stated in an order suggestive of their interconnexions.

If, in accepting certain philosophies in a general way, there is dissent from some of their findings, or a gloss is put upon their definitions, it is with due diffidence that this is done. When comparing various representative philosophies of art it is always worth while to seek to reconcile their terms; to see whether they do not very often mean the same thing, even when their exponents have been quite satisfied that they meant something quite different.

5. *The Illustrations*

A word on the illustrations which accompany the text may not come amiss. It might have been preferable to leave the text unillustrated; firstly, because few points are made which could not as well have been illustrated by any one of a hundred examples, and secondly, because it would do any reader some good to find, or make up, his own illustrations. In many cases where specific works of art have been mentioned by way of illustration, no views are provided, but some care has been exercised to refer in this way only to things that 'every schoolboy knows'; or might be expected to know if he is a student in a school of architecture.

However, when no less an authority than the late Mr. Batsford expressed the view that nobody would read, far less buy, a book entitled DESIGN that was not also a picture book, and when he cited the case of Eidlitz's *Nature and Function of Art* (1881) and presented to me one of the few copies extant, the advice was taken and the drawings were set about.

Now there could be no cause to complain if any one of the few who have read Eidlitz described this book as 'Eidlitz up to date'. Of course, his zealous fire, so characteristic of those who wrote of art at a time when to do so meant the espousal of a vivid cause, is lacking here; but, inasmuch as Eidlitz sought to bridge the gap between the artist and the public, one may acknowledge a similar impulse. What Eidlitz calls 'vague knowledge' is in no way to be distinguished from Croce's 'intuition', his 'common sense' is the Italian's 'practical'. The fact is he wrote before his time. The times move fast to-day and the difficulty now is that the science and philosophy of yesteryear become obsolete while they are being formulated. No one writes before his time to-day.

But all this apart, it is amusing to speculate on what might have happened, supposing Mr. Batsford was right in his view that Eidlitz's book lacked only illustrations to give it force, and supposing also that it had been issued, adequately illustrated, ten or fifteen years later. The course of American architecture might then have reflected somewhat different tendencies during the first quarter of the present century.

6. *The Situation To-day*

In these days the artist's, and particularly the architect's, education is loaded on the one hand with new science and on the other with the residual midden heap of four hundred years of archaeological research, achieved with ant-like industry, to the end that the occurrence of variations of form might be recorded, even when they could not be explained. So far as living art is concerned, it is the similarities of underlying principle in the forms of the past and not the superficial differences that really matter.

And now at last the aesthetic problem seems near to solution; near enough for a serious beginning in its practical application. What there is of promise in the arts to-day, especially in the arts of design, may well be accounted for by recent progress in aesthetic inquiry. But if the philosophers are at last getting on to firmer ground in this matter, it has not been without a struggle which has had a very disturbing effect on the waters. This is perhaps why, at a time when cosmos is here and there manifest, so much of chaos is still prevalent. The disturbance above alluded to has made the heathen rage in anarchic delight. So there has been jazz music, jazz dancing, jazz poetry, jazz painting, jazz sculpture, and, worst of all, because most permanent and obtrusive, jazz architecture. Now, if philosophic disputation has got us into trouble, it is to philosophy that we must look to get us out of it.

Instead of losing our heads in the present turmoil of violent and meaningless form, let us see if it cannot be shown that there is more of identity than of difference in the various phases of design which have been manifested during the last three thousand years, for all the specific differences we have been encouraged to explore so sedulously as appertaining to ancient Egypt, Periclean Greece, Medieval England, eighteenth-century France, and Modern America. If so, there is indeed a basis for good design. Failing to establish an 'aesthetic ought' it will at least be something to establish an 'aesthetic may'. It is with the conviction that recent advances in the philosophy of art facilitate the establishment of laws---laws which demolish those 'rules of art' still cited in the 'Code Napoléon'—that what follows has been set down.

This book is as much concerned with the appreciation of the monuments of the past as with the evolution of the monuments of the immediate future. If it does not restore the stone which is lost, it may be helpful in giving direction to the search for it.

7. *Personal Note*

The best work on salmon fishing within my knowledge, and I have read many such, was undertaken by a gentleman who, after mastering the bibliography of his subject, stated that there was no other way to find out what he wanted to know than to write a book on the subject. *Ars longa, vita brevis,* and to the reading of books on art there is no end. With no claim to mastery of the bibliography of my subject, I yet find myself in much the same position as the fisherman, and have written primarily with intent to alleviate my own ignorance.

It ill becomes a man who ventures into print to profess modesty.

A heart of gun-metal and a brow of teak can alone sustain him in face of his critics, if art be the theme and English the language. A certain honesty of purpose prompts me to reveal my qualifications to any who have persevered thus far. Brazenly I inform the reader by what manner of man he is accosted and what are his qualifications:

Many men of many races have been his masters: artists, scholars, prize fighters, statesmen, craftsmen, merchants, soldiers.

Proud cities, raw townships, quiet villages, in the old world and the new, have harboured him in the study and the practice of his trade.

The treasures of three thousand years of civilization have been the chief source of his delight since childhood.

He has been given intervals, travelling the seas, lying in hospitals, and enduring depressions of business, in which to collect his thoughts.

He has experienced all the relationships of ordinary human life, and known the zest of work and sport and war.

His acquaintance with philosophy, history, and science is superficial; his experience at the drawing board—his masters', his own, his students'—extends behind him for forty years and more.

Every day in all these affairs of life he has taken cognizance of the aesthetic fact fulfilled in many ways. Whether a flirtation with a lady old enough to be his mother, or a visit to the Greek collections in the Hermitage at St. Petersburg—both events took place in 1885—first turned his thoughts to the hows and whys of emotional expression, he cannot say. By 1887 he thought he knew all about it. To-day he is wiser.

8. *Obligations*

There is no copyright in ideas, but there is an honourable practice in the matter of acknowledging other men's happy phrases. To this it is not unlikely that violence is done herein. How far the views herein set forth are original and how far the borrowings of a careless intermittent student I am unable to say, nor does it matter.

There is something consoling in the view that footnotes and references mar a page as much as extraneous advertisement of tradition would mar a monument or a picture. Where phrases herein are quoted consciously use is made of the recognized indications. Some of the sincerest passages that follow are written against that interest in origins and influences which obscures so much of the critical appreciation that has been bestowed on monuments and pictures.

9. *The Student*

But let us revert to the student of design. Mental discipline is his greatest need. Without it the bountiful supply of documents, enshrining the concentrated traditions of the past, will go far to pervert his powers. Scholarship has made many style-mongers. Of those who have discovered eloquent form, some have been learned in the mannerisms of the past and some have not. They have all been endowed with the power of straight thinking and the ability to feel strongly. The tender seedlings of the student's own common sense and of his natural feelings are sorely in need of protection. He has access to too much appertaining to the architecture that has been and to too little that deals with the architecture that might be.

Let him cut his scholar teeth on the fully developed Greek Doric and the fully developed Gothic of the fourteenth century. The better he understands these, the less will he be inclined to imitate either in the twentieth century. And for all the rest, perhaps the less he knows about them the better; that is if he happens to have the stuff in him to be a discoverer of form. The indoctrination of the respectable practitioner is quite another matter. Others have written abundantly to supply the needs of his case.

II

THEORIES OF ART

1. *Philosophers and Art*

FROM the days of Plato and Aristotle, and probably from long before their time, down to the moment of this writing, the philosophic mind has been wont to turn its attention to the arts in their various manifestations, design included, viewing the activities of the artists and the antics of those who buy their wares as phenomena worthy of explanation, or as conundrums on which to exercise their faculties. Now, there was never an artist that really mattered who did not know quite well in his bones, as the saying is, what he was about, or who really required a philosopher's help in the matter. But with those who buy the artist's wares the case has been different. Hence the critic and a philosophy to support him.

Literature, from its very nature, cannot help being affected by all philosophies, ancient and current. It has thus served as a medium to pass on to the connoisseur, the buyer, and the building owner—to all those in fact who have any part in the complementary function of receiving what the artist has to give—a heterogeneous mass of philosophic thought and comment on art, presented in more or less mutilated form. The corruption of the integrity of the response to art is the result.

Since the invention of printing enabled the written word to replace the visual arts as the main democratic vehicle of expression on things in general, this indirect influence of philosophy on art has been enormously extended. What one generation of philosophers promulgates, the next generation of historians, essayists, poets, novelists, journalists, and critics disseminates; and the next generation of artists has sought to put into practice willy nilly, on the erroneous assumption that one must live. Aesthetic is the name usually applied to this body of speculative thought, whether it be regarded as a branch of philosophy, or as a science.

Your modern philosopher, when he turns aesthetician, is usually very doubtful of the expediency of deriving artistic precept from his findings. To give him his due, this is not so much from a fear of a possible *reductio ad absurdum* as from an Olympian attitude of mind—a sense of his prerogative to regard art and artists as phenomena.

But the artist has a lively interest in what is said about him and his work; it may affect his living; it must affect his reputation, now or later. The modern student of art and the modern art student, once they become cognizant of aesthetic, are not slow to investigate it for what it may offer. The student of art seeks explanation of such phenomena as the pseudo-archaic movement in the Greco-Roman world, the rebirth of classic taste in the fifteenth century, and the Gothic revival in the nineteenth; while the art student demands a creed that will hold water. Both soon become alive to the fact that the last century and a half has produced an enormous literature of art, tainted on half its pages by propagandist zeal, based upon irreconcilable aesthetic doctrines.

It is not necessary here to recount the evolution of aesthetic thought. That has been done very adequately by many aestheticians during the last thirty years, in their prefaces and in their appendices, the better to clarify their own positions. On certain of the positions taken in recent contributions there will be something to say; for these represent a great advance towards a common-sense view, and one hesitates to await three generations for its full effect.

A learned colleague[1] has recently written a *History of Taste*, and one might easily be tempted to trace the effect of the evolution of taste—the taste of the writers and the thinkers—upon subsequent performance in the arts. A brief outline of the problems with which aesthetic seeks to deal is all that can be attempted here.

2. *The Inquiry defined*

Confusion of thought between aesthetic, the science of expression, and hedonic, the science of the agreeable, is an unfortunate characteristic of much writing on the subject of art in the English language. It will be well to clarify what we may call the modern position from the start, even if this involves assumptions to be substantiated in later pages. There is an inevitable relation between aesthetic and hedonic activities; the former involve the use of the latter. The relation is that of master and servant. There are things a master cannot do at all, and things he cannot do so well, without the help of his servant, but it is he who has the responsibility. This dependence is not mutual, for though each is dependent on the other, each is dependent in a different sense.

---

[1] F. P. Chambers.

It may be convenient at this stage to categorize the main questions which aesthetic seeks to answer. The first group comprises the broad fundamental problems to be discussed in this chapter: What is art; what is an artist; what is a work of art; what is beauty?

The second group concerns itself with corollary matters such as the public taste, fashion, types, ideals, and the criteria. Later an effort will be made to deal with colour vision and form vision, with a view to supplying the reader with something in the way of a scientific basis for his approach to the problems of design. The artist may as well know what he is doing when he invokes the service of the hedonic in his aesthetic activities.

Now, this formidable array of questions and corollary problems, if it is to be resolved at all, involves the formulation of a series of definitions, all too apt to be in terms of one another. This is somewhat akin to disentangling a very long line with a great many hooks upon it as a preliminary to catching fish. We may expect occasionally to come across odd bits of string that look very like line, looped in with invisible knots—vicious circles. When this is so we require scissors. In using them one must try not to cut the line. The reader is therefore warned to be on his guard; for the writer may very likely blunder.

3. *The Underlying Sciences*

Many of these classic and immemorial questions cannot be answered to-day by mere dialectic in the way that it was open for any one to deal with them a century, or even half a century, ago; for there have been enormous advances in certain sciences of late. Where these have any bearing on the points at issue their aid must be invoked.

Archaeology has been making spasmodic contributions to aesthetic ever since the dawn of the Renaissance—spasmodic, because at different times archaeology has turned its attention in diverse directions, depending on its opportunities. It has now reached a stage where future researches may be expected to substantiate its established theories, rather than to provide food for new ones. Psychology has been freely drawn on by the aestheticians for a century and more; in fact, since long before it had a name. Physiology has been appealed to with ever-growing emphasis for half as long, though only effectively in recent years. Physics is the last of the adult sciences to throw light on our problems. And now we have the new generation of cross-bred sciences, psycho-physiology, psycho-physics, and the rest, offering rather insistently to take a hand in stirring the aesthetician's pudding.

It is well for the inquirer to bear in mind that, in all these sciences, there are very definite limits as to ascertained fact; beyond these, theory based on assumption, hypothesis, and supposition has to be invoked. Also there are many matters pertinent to the answering of our questions, particularly in the field of form vision, on which hypothesis has not yet even been attempted. We, to-day, know far more than we did twenty years ago about how things are seen—quite enough to explode several time-honoured beliefs on which the technique of the visual arts has been founded; but, it may as well be confessed sooner than later, not yet very much.

It is the extraordinary lack, on the part of many fluent writers on art, of even a nodding acquaintance with the present state of philosophy and science, which renders the labour of these pages of a possible use to the book-bedevilled student of design. It is high time that some of the current superstitions with respect to 'the nature and function of art' were laid to rest. If one is here so fortunate as to make a beginning of the end of some of them, it is with the hope that others will continue the task.

These misconceptions stand in the way of mutual understanding between the artists and their public, and especially affect those who have the relation of architect and client. Art, as it will presently be seen, is essentially an affair of giving and receiving. It is rendered abortive when there is no free hand with which to accept.

Most of these superstitions have their origin in mistaking the means for the end; in confusing the aesthetic with the hedonic; in assuming that delight and insight are synonymous terms. Once one becomes possessed of the idea that it is the function of art to please one is headed direct for the 'Epicurean sty'. The artist must then take his place professionally, as many artists seem quite content to do, between the barman skilled in the mixing of elixirs and the daughters of Lilith, expert in carnal delights.

All which has been said before with more elaboration, but, apparently, with little effect.

4. *Croce's Aesthetic*

With two reservations, the reader is asked to accept the position of Benedetto Croce as set forth in his *Aesthetic as General Linguistic* in 1907, referring to Douglas Ainslie's translation of 1909, to fill out the arguments here only epitomized. This work made much stir at the time it appeared and has profoundly affected the views of all who have become familiar with it since. It may be mentioned that there are some who would have preferred that the translator had used the word 'mind' throughout, rather than 'spirit' as an equivalent of the Italian *spirito*.

As to the reservations: while one may be prepared to go the whole way with Croce in identifying artistic activity with expression, one may not be prepared to come the whole way back again by his route and admit that all expression is art. The difficulty seems fundamental, for expression is a universal phenomenon. It is inherent in every act and work of man. It pervades all nature. In these pages aesthetic is understood as the science of expression, which is an aspect of all things that are. In its own way, it is an explanation of everything. But art is not universal; far from it. There is an essential difference of kind between a map of Sicily and a madonna by Michelangelo where Croce seems to see a difference of degree only. Both are expression, the former is not necessarily art.

Once, when very young, the writer heard a lecturer on art, whose name he has shamefully forgotten, define art as 'expression by arrangement' and cite the difference between ordering a pint of claret in which to drink the health of a young woman before departing for the wars, and saying or singing:

> Go fetch to me a pint of wine,
> And fill it in a silver tassie, &c.

In both cases emotion is expressed by the act. The order, 'Waiter, a pint of Bordeaux and two glasses', informs, but leaves the hearer cold. The words of 'Rab the Ranter' infect, and we feel as that long-dead soldier felt, or, at least, as Burns felt that he felt.

There you have, in a nutshell, the difference between art and not-art. Modest pint of modest claret, or magnum of vintage champagne, it makes no difference. It is not the quality of the libation, but the quality of the words that enshrines the sentiment. Nor need one have shared the common experience of our generation and have departed for the waste places whence 'the sounds of war are heard afar' to realize what Burns wanted and knew so well how to put into our hearts.

Now, that map of Sicily might be far more than a mere map. It might be the work of some one who loved, besides knowing, the contours of the land he portrayed; of some one who knew why he loved it with its harbours and ships, its hills and temples, its streams and towns. If he so made his map that he also made another also to understand and feel how he loved Sicily, or even only why, then the map would be a work of art, and he an artist. Such maps there have been, and plenty of them, but it is 'the outline of a country drawn by a cartographer' to which Croce alludes.

In any case, Croce lets us out of the difficulty by elsewhere alluding to 'what is generally called art'. It is with certain aspects of this more limited thing that these pages are largely concerned.

The successful exercise of the faculties is the basis of all satisfactions—those shared by the astronomer exploring the universe with the hungry student of his mathematical acrobatics; also, and as poignantly, those shared by the discoverer of form with him who contemplates the form discovered. The hedonic is as universal as the aesthetic. Design, the discovery of form, is subject to both aesthetic and hedonic law, whether the resultant object be competent only to explain itself, or be also competent, as a work of art, to transmit and revive something out of its author's heart, soul, spirit, or mind. Call it what you will, mood is as good a word as any.

The second difficulty with Croce is perhaps really only a regret that at one point he did not go a little farther to make his meaning fully clear. He makes a formidable onslaught on 'the theory of the artistic and literary classes'. By this he seems to mean the eighteenth-century laws of taste. He is at his best in pouring scorn on the sculptor who adds a spurious symbolic explanation of his work, and the writer who attaches a moral to adorn his tale, after it is told. What he would be at is the exclusion of general concepts from the field of art and the denial of the efficacy of those 'laws of styles' which are based on the principle that a particular formula is appropriate for a work of art expressive of a particular concept.

It has been stated above that art concerns itself with mood and not with concepts; but is there really a difficulty in its making use of concepts to provoke mood. When Lady Dilke wrote of 'the calculated effects of architecture' she certainly implied rules, but she was far too understanding a person to have meant anything very different from mood by the word 'effects'. The eighteenth-century architects she was writing about very probably did believe they were expressing the 'sublime', by the help of certain formulae, when transmitting a mood in their view so exalted that superlative phraseology, used expletively, alone sufficed in giving tongue about it. This, after all, was only a case of the untranslatability of the work of art, which is inevitably unique in content.

Now, from all that Croce has said so well on translations and the unique nature of every work of art, it follows that no vehicle of expression can describe, far less express or transmit, all moods. This the critics continually forget. There are things of the 'spirit' that can only be said, others that can only be danced, and others again that can only be built, and so on with all the arts, ancient and modern and yet to be.

But there are tricks in all trades and the several arts are no exceptions. The architect, worthy of the name, knows very well how and when to make a façade smile or frown. If the smiles and frowns he deals in are not precisely analogous to the smiles and frowns the sculptor imparts, through an understanding of physiognomic contortions and clay and marble, they may be no less intentional and they equally depend on knowing how, on experience, on rules. Without this 'knowing how' the architect could not even have the conception of the smile or frown for his façade. Impressions are not best expressible, but only expressible, by handling of a medium. Technique sets the limits but it also provides much, sometimes all, of the inspiration.

If the kind of impressions of which architecture is redolent interest you, you study to become an architect; and you study to become a poet or a dancer for similar reasons—that is called your taste for this or that art. In this sense there is perhaps room for a 'theory of the artistic and literary classes' and the rules therefrom dependent. Once we realize that it is mood and feeling and not abstract concepts that they have to do with, the difficulty vanishes.

5. *Tolstoy and Hirn*

Count Leo Tolstoy's contribution to the aesthetic problem in *What is Art?* (1898) is somewhat marred by several obsessions of a moralistic kind which lead him to make his appreciations of expressions dependent on his view of the social value of their intentions. In a serious study of art as an effective activity, surely good citizenship might be left out of the question. It was as good citizens, not as artists, that Michelangelo regretted his Leda, and Boccaccio his Decameron. For Tolstoy, Greek sculpture was obscenely nude. His misfortune in having that kind of a mind is his excuse, but not his justification, for regarding it as bad art. But, whatever his difficulties with good art and bad art, this great artist has given the clearest exposition, up to his time, of what is and what is not art at all. The 'infection' of the artist's public—the reader, the beholder—with the emotion of the artist through the work of art is his all-sufficing touchstone. If he flounders in confounding content with theme and in confusing good citizenship with good artistry, we can well forgive him. The masterpieces of Greek sculpture leave him cold for the same reason that the masterpieces of Renaissance architecture left Ruskin cold—he did not approve of them—there was a defect of sympathy in the critic.

Throughout his *Origins of Art* (1900) Yrjö Hirn has a good deal to say about the ways of primitive peoples, as might be expected from his title. In his chapter on 'Art the Reliever', which is another of the milestones on the road the student of modern aesthetic doctrine must tread, there is a most convincing exposition of the impulse to seek expression as a solvent of distress. Marshall in his *Pleasure, Pain, and Aesthetics* (1894) covers the same point from the frankly hedonistic point of view, so generally characteristic of English writings on the subject in his day. While both psychology and aesthetic have travelled far since Hirn and Marshall wrote a generation ago, one has still no difficulty in accepting the general thesis of these writers to the effect that pain is diminished and pleasure enhanced by expression. Now, an ejaculatory 'damn!' as explosive as the shell which has robbed one of a comrade, may be so heartfelt and its hearer may be so understanding that it has all, and more than all, the force of an 'In Memoriam'. But the 'damn' is not a work of art and a memorial poem may be one. It is not the elaboration that makes the difference, but the intentional materialization of a monument to a state of mind that does so. Some call for sympathy in distress, or in jubilation, is present in a great many things that are said and done; perhaps in everything we say and do. The hedonist's 'light and shade of experience' may be taken as universal. Art fixes this light and shade in a secondary expression.

Thus one may restrict the true content of art—of that thing we are dealing with 'which is generally called art' as distinct from the casual blossoms in the universal field of expression—to emotional matters. In so doing one restricts the work of art to the function of an *aide mémoire* dealing with a mood. Art is not the expression of fact, or fancy, plus emotion; it is the expression of emotion plus whatever facts, or fancies, can be enlisted in its support.

Natural objects and designed objects have characteristics which are the expression of function and material and process; and several chapters will be consumed in the exposition of this mechanistic expression and the laws which determine it. Where art enters the fabric of design it begins inevitably where pure designing, such as occurs in Nature, ends. It is this that has misled so many into regarding art as expression of fact or fancy with something else added. The physical dependence of a work of art on a useful object, automatically expressive of itself, must not be allowed to blind one as to the integrity of the artistic expression which uses the useful object, together with other facts or fancies, for its support.

Whether in books or buildings, pictures or pirouettes, art is usually largely concerned to express the feelings of the designer with respect to the thing he has designed. It is often too readily assumed that all the 'light and shade' is inherent in the object, when the best part of it is in the artist's experience of the object. Through engineering the object expresses itself; through architecture the designer expresses himself. There are, of course, many engineers who are artists, and all architects should be engineers before they seek to be anything else.

6. *Santayana*

The word 'beauty' has occurred but once so far in these pages and then in a tabulated list of the problems of aesthetic. One may now dispose of it with the help of Georges Santayana, and it is unlikely that there will be much occasion to make use of the word later, for it is one of those flabby, question-begging terms that confuse discussion. The word 'beauty' has indeed no proper place in the vocabulary of the intelligent critic. In *The Sense of Beauty* (1896) Santayana has dealt very faithfully with the matter. Like most aestheticians, once he has explained its meaning he makes bold to use it freely.

Terms of approbation and disapprobation—beautiful, lovely, pretty, charming, and the like on the one hand, and ugly, hideous, detestable, on the other, are just mere ejaculations in the form of adjectives. They are not descriptive of things, for they really tell nothing about them; but they do tell a good deal about the people who use them. They inform us that the person writing or speaking such words derives, or thinks he ought to derive, from the contemplation of the objects to which he has applied them, certain experiences, both qualitative and quantitative, of delight, satisfaction, pleasure, interest, or of the opposites of these. The fact that most people of a given race, speaking the same language, similarly brought up, react in much the same way to most of the vicissitudes of experience, gives these words a certain descriptive currency value. Santayana defines beauty as 'pleasure regarded as a quality of the thing' and there is little likelihood of this definition being improved upon. It at once exposes the inanity of such combinations of words as 'true beauty' and of the famous phrase that enshrines the Baumgartian trinity—'the good, the true, and the beautiful'; besides it obviously renders any attempt to explain art in terms of beauty open to grave suspicion. To define aesthetic as either the philosophy of the beautiful, or as the science of beauty is, of course, to confuse aesthetic with hedonic.

Now, the thing of which beauty is alleged as a characteristic may be a natural object, or a work of man, and in either case, unless there be tone of voice, or other qualifications, the word conveys nothing as to the mood, humour, sentiment, or frame of mind involved, though a good deal may often be inferred from circumstances and context. If my cook tells me the chicken the butcher has sent is beautiful, my knowledge of cooks in general, and my cook in particular, may enable me to form a good idea about the size and succulence of the fowl in question; and of the quality of the emotion it evokes in my cook.

To aver that a thing has beauty is not only to express an opinion as to some quality, but to admit that one is not neutral and indifferent on the subject; it is an implication that one could say more as to how one felt about it, though possibly not as to why one felt so.

It has often been maintained that beauty exists only in works of art—that is to say that beauty cannot properly be alleged of works that are not in any sense works of art, and far less still of natural objects. On the other hand, in the field of design the approving word has often been applied in frank recognition of organic qualities such as are invariably present in natural objects and are inevitably attempted and more or less achieved in design. Structural organization is not art, though sometimes it is the theme of art. Its recognition may quite fairly evoke the remark, 'This thing is beautiful'.

It is quite unnecessary to construct a recondite aesthetic which reserves solely to intentional works of art the right to be described as beautiful. Of course, one may say with Croce that all expression is art and in doing so admit all the works and sayings of man to candidature for the coveted compliment, while still excluding natural objects. 'Beauty' and all kindred words can really be done without quite well, but, if we use them at all, let it be, as they have always been used, for general application to anything natural, or artificial, which happens to delight us. That does not prevent our reserving for the designation 'art' certain only of the human activities that delight us.

7. *Marshall*

Psychology was still young—it is not yet very old as sciences go, when it turned its attention to aesthetic and hedonic phenomena. Whatever may be the views of the later and rather commercially minded exponents of that science, some of the earlier findings seem reasonable to artists. The description of pleasure and pain as the 'light and shade of feeling' already referred to is at least a happy figure of speech quite applicable, if by feeling is meant, as in these pages, emotional experience. Confined to the range of sensations this may not be a sound way of putting it. If the nerves of pain and pleasure belong indeed to separate systems, as now seems well established, the figure of speech would need some revision, if it is to apply to feeling understood as bodily sensation.

On the re-presentation of the pleasurable and the painful the older school, of which Marshall was a distinguished representative, arrived at a conclusion with which few will quarrel. It was this: the pleasurable is always pleasurable on re-presentation while the painful is never painful on re-presentation; but tends towards the pleasurable. If this be so, and we cannot conceive the matter otherwise, Tennyson was somewhat at sea when he wrote the lines,

> As when a soul laments which hath been blest,
> Remembering what is mingled with past years,
> In yearnings that can never be expressed
> By sighs or groans or tears.

First of all, the poor soul's remembering of blessings in past years would have a distinctly cheering effect. Perhaps it was the number of the years remembered that caused the depression of spirit, but the poet does not say that at all. Then we have the announcement that sighs and such-like reflex expressions of emotion were quite inadequate to give relief. For this the yearnings would demand artistic exploitation. That is sound, or at least accords with the theory, once the state of mind is admitted; but the state of mind is incongruous. When one has eaten one's cake, any regrets are associated with the absence of more cake. One does not really lament the old one, it remains as good as ever, if not better.

It would thus appear that the aestheticians and the hedonists are at one in assuring us that the world is a pleasant place for those who know how to exploit their sorrows, and a very pleasant place indeed for those who know how to exploit their delights. It is to be hoped that they are right.

To make others feel what he himself has felt—the gain of sympathy; that is what the artist is always trying to achieve. One must place the art impulse where it really belongs among the phenomena of hysteria, and leave it at that; adding only that all successful democratic politicians and all great autocrats and commanders have been artists in this sense.

What has Marshall to say on the work of art; this thing that turns all into gold?

> 'It thus appears that the great artist primarily reaches out to the production of a wide non-painful field by the elimination of ugliness. Beyond this, however, he must go, bringing into existence a broad field of moderate pleasure-getting without permitting the loss of those centres of interest which are supreme for him, and which make his work of art ideal and individual.'

In view of all that has been said above it is unnecessary to dissect and analyse this ponderous statement; it tells in a way what the artist does but says little as to why he does it. The essentially monumental intention of the work of art, if not directly stated, is implied. The artistic impulse is at bottom a conviction on the part of the artist, momentary it may be, or even erroneous, that how he feels about something is well worth remembering. Whether the artist be professional and dependent for his daily bread on feelings worth remembering, or amateur and free to memorialize his feelings or not, the impulse is the same. It may be added that the feelings of the amateur are not infrequently quite as worthy of 'relatively permanent' immortalization as those of the professional artist. But the professional artist has certain advantages of inspiration when once the materials for the 'monument to the idea' are in his hands.

8. *The Senses*

There is only one avenue, though that contains several paths, whereby one mind may hold communication with another (telepathy and the occult sciences not excluded) and that is the avenue of the senses—direct or remembered. The use of the avenue always and inevitably involves materialization—the 'monument'. In the case where the expresser is his own public, ability to materialize and to imagine the 'monument' may take its place. All expression depends on sense. Some of the senses, as taste and smell, are hardly available, and then only very indirectly. Touch is, however, more potent. But things heard (which are mostly made up of images or symbols of things otherwise apprehended) and things seen (which on ultimate analysis are little bits of indirectly acquired knowledge as to matters exterior to the organ of vision) are on an altogether higher plane, when viewed as means of communication. When making sounds and engendering sights we all come within measurable distance of creating, whether we are acting as artists or not. The artist does not just create in every way bigger, better, and more efficient sounds and sights than the non-artist. He contrives sounds and sights simply to convey impressions, and what facts, or fancies, he relies on to help him are his affair. They would not be his affair if they were not in some way interesting to him. In virtue of that interest he regards them as beautiful. It may happen that no one else does so, or that the beauty some one else finds in them is differently constituted from the beauty he found.

Artistic tradition provides the code through which the artist says what he wants to say. If he insists on inventing his own code he must not complain if no one understands him. When a tradition is stagnant it means that there is no artist with anything to say. When a tradition is alive it is always changing; this means that much is being said—in words, in sounds, in forms. The standardized grammars of speech and structure provide for ordinary expression. But code arrangement of words and parts conveys feeling as to what is being written or built, and often as to some extraneous thing. Otherwise all sentences would be simple and all structure reduced to construction.

Now compare the passages,

'They bellow one to another,
The frighted ship-bells toll,'

'The steamers were sounding their fog-horns, and the anchored sailing ships rang their bells as a precaution.'

If the reader cannot see the full significance of the difference in these quotations, we advise him to go no farther. The argument presented is erroneous, or his mind is blind to image. In either case he wastes his time on these pages.

9. *Artistry*

Once arrived at the point where art can be defined as distinct from expression of 'fact', the way is cleared for the exposition of artistry. By fact is here meant that which is believed, alleged, supposed, or assumed and stated; not that which is demonstrably true. When one thus differentiates between statement on things or the relation of things, and statement on how one feels about those things, or their relations, it must be borne in mind that without the first there cannot be the second. There can, however, be expression on fact with no expression on feeling adjoined thereto.

Contract forms, engineering operations, maps, and scientific data do occasionally get written, carried out, drawn, or expounded in absolutely cold blood, so to speak, but not very often. Even those who think straightest are apt to take pride in the fact and to show it. On the other hand, feeling, the real subject-matter or *true content* of a work of art, is not independently expressible; there must always be that other supporting subject or theme which some prefer to call the *occasion*. While it is true that either the occasion or the true content may be the thing of real importance in the expression as a whole, there is inevitable dependence of the one on the other. While this is rather obvious in the field of design, to which this volume is dedicated, it applies to all works of art, whatever their purport and whatever their means. Conrad never had any doubt about it, that what he felt about certain kinds of people in certain kinds of situations was what he wanted his readers to feel. But before he could make them do so he had to assemble the people and the situations from his experience of life. Mr. Briscoe, the etcher, invites us to participate with him in realization of the gambling chance between rigging (itself a matter of design), wind, and weather; but before he can do that he must represent sea, sky—and through these, the wind—and the vessels with their keels twenty feet deep in the one element and their top gallant sails a hundred feet aloft in the other. Rodin would invoke in us the mood of puzzled thought, or of passion, or of humiliated distress, but he needs his primitive man, his kissing lovers, or his burgher of Calais to help him do it.

Whether a given phenomenon of expression is to be regarded as a work of art or not is largely a matter of approach on the part of the reader, listener, or beholder. Most expressions are, as we have said, more or less works of art, and can be appreciated and appraised both as statements of fact (as above enlarged) and as statements of feeling.

Complete accomplishment in the wide field of aesthetic, and therefore in the narrower field of art, takes place when the recipient—hearer, reader, observer—derives from the materialized expression precisely what the artist has sought to embody in it. This is the criterion. From the nature of things complete accomplishment is rare; and, again from the nature of things, there is a premium on clarity. Where mood, as distinct from fact, is the article of exchange between mind and mind, there can be no proof of persisting identity and we fall back upon thaumaturgy to proclaim a communion of spirit, real, approximate, or feigned, with Tom Scott or Michelangelo. If one knows the spirit of the Border riversides, or the spirit of sixteenth-century Italian thought and action, one may not be far wrong in one's proclamation.

Before going farther the reader is invited to accept the position that expression is all-pervading and that it is open to any one to find and realize beauty therein; also that a certain class of expressions can be distinguished from the rest in that they convey mood. This class is designated as art. Definitions both of beauty and of the work of art have been accepted; these definitions are not in terms of one another. 'Pleasure with pain for leaven' has been allotted a place in all these matters and the working of the leaven has been demonstrated. Lastly the artist has been dealt with. If he has been found to be a creature of impulse, it is fair to say that he need not on that account be reckoned a fool.

For the reader who has persevered thus far in the hope of more concrete particulars a word of cheer is offered.

His position may be something like that of Alice in Wonderland at the juncture in her adventures at which Humpty Dumpty was able to give her the assurance: 'It gets easier as it goes on.'

III

AESTHETIC PHENOMENA

1. *The Public*

SOME of the fundamental issues with which aesthetic seeks to deal have already been touched upon by a process of enlarging upon definitions derived from various sources. Thus far the whole matter has been regarded chiefly from the point of view of the artist. We now turn to the public, or in the jargon of psychology the 'recipient'; this may mean the artist himself, some other individual, a cultured group, that aggregate of ordinary intelligent people called 'the man in the street', the many-headed multitude, or even the bulk of humanity from generation to generation.

It is no criterion of excellence that a work of art should be appreciated by a cultured few, or that its appeal should be as wide as an empire; but it is a criterion that it should reach the understanding hearts of those for whom it is intended.

As already remarked, the work of art need not be actually materialized in the case where the artist and the recipient are one and the same person. It may then be achieved in imagination only and enjoyed in memory of the image; but strictly on the condition that the artist is not only willing, but competent, to materialize it successfully. Otherwise he deceives himself with a bluff. The unmaterialized work of art soon loses the edges of its unique identity and drifts off into the gulf of memories of memories of memories, a mere drowned corpse of an impression.

The great works of art, destined for one person only, are of course to be expected among the love-letters of the artists—'Raphael's sonnet'—but such of these as have been preserved to us from the pens of professional littérateurs often have in them a something suggesting that their authors would not feel outraged if they were kept and published later. The 'Song of Songs' is not in this category, for it is nothing if not a public announcement. We of a later generation, who peruse these sheets addressed originally to a private ear, can hardly be expected to attune our captious organs to what may be called the appropriate wave-length, although easily arriving at the conclusion that these sheets were also meant for us.

Then there is that public which, few in number, makes up for its numerical inferiority by wealth of understanding. 'The chosen few' is their designation by the artist who addresses his achievements to their attention and sympathy. Perhaps he uses this flattering title as much to appease his own vanity as to conciliate their indulgence. Subtlety is, of course, wasted on the common man, and art has been at its finest, though not necessarily at its greatest, when making a strictly limited appeal. For many an artist, this limited appeal to those of his own cult is all that matters; but it is well for him to remember that there are other artists and other cults and that his cult, if it be imbued with propagandist zeal, loses its virtue as a cult precisely by the measure in which it succeeds as a mission. A less select public may thus await him.

Now what of the man in the street? It is on his suffrage that the ordinary opportunities and worldly success of the artist chiefly depend. His very important existence is mentioned at this point, but more will be said about him later in discussing just what is meant by the 'spirit of the age'. In his aggregate personality he is a far more intelligent creature than he is often given credit for being; he can hardly be labelled ass, Babbitt, barbarian, without calling forth the fair rejoinder pharisee, dilettante, highbrow. The artist who addresses his efforts to the man in the street may be as great as any, if he has as sincere a sympathy and understanding, on his side, as that which he demands. Otherwise the man in the street will surely find him out, if not in this generation then in the next.

Mention of the many-headed multitude, often referred to in select circles as the 'common herd', is now due.

> The song I sing for the minted gold,
> The same I sing for the white monee,
> But best I sing for the stoup of meal
> That simple people given me.

That is the attitude of many an artist. It is an inspiring one when it is wholly genuine and not a mere reaction from the blows and buffets of a bad time with the critics, or a misunderstanding with the connoisseurs.

One often notes a common misapprehension as to the true position of the client—individual, committee, or subscriber behind the committee—who commissions the artist to produce a work of art.

In the case of architectural efforts the client, whether individual or multiple, provides those expensive and bulky ingredients of materialization—land, stone, and labour. Is the client a part of the public? When he is acting as client, certainly not. He is then part and parcel of the artist; and if he shares in the prejudices of a chosen few, of the man in the street, or of the many-headed monster, that makes no difference. Whether the commissioned work is to make its appeal to the first, the second, or the third of these publics is a matter for adjustment between these co-partners. It is precisely because the client—individual or corporate—wants to make appeal to a public—great or small—that he commissions the artist to help him. If that were better understood, how much happier would be the normal relations in such cases. For all the covenanting and agreeing there may be between the parties it is in essence a case of We.

2. *Taste*

The exercise of taste by the artist will be considered when style comes under review. Taste as manifested by the public is founded on ideals, which in turn are based upon 'the residues of past experience'. One's likes and dislikes are largely matters of expectation. 'That is the funniest tea I ever tasted, but it is sweet,' said a backwoods child on being given a cup of exceptionally good chocolate. The flavour of the unrecognized ingredient bewildered, that of the recognized one satisfied. Banality may only bore the chosen few, initiates of the mysteries of artistic caviare and triple-sec; but it may be the very stuff to reach the heart of a wider public, responsive to the kippers, and bitters, of vernacular art.

The culture of every age has sought its own definitions of taste, or rather of good taste, and nothing less true was ever uttered than the celebrated aphorism *De gustibus non est disputandum*, with which many a highly enlightening discussion on the subject has come to an ignominious end. But, whatever has been the case with the rules of good taste, the laws of taste change not at all.

Consider for a moment the slowly evolved costumes of the various peasantries of Europe to which they adhere so tenaciously. Within strict limits there is latitude for personal idiosyncrasy in each; and consequently there is, and has ever been, an evolution in every one of them. And consider the products of the fashion-mongers, always seeking some new thing, and as often as not resurrecting some old thing, as their fevered charting of our 'progress' zigzags between the extremes of invention and retrospection, or between the limits of decency and prudery.

Let us call the peasant's taste 'natural', and recognize that it is founded on the habitual. This is what furnishes a basis for comparisons and the assessment of values. For where all are dressed alike (as also in the several arms of the services, or in the case of civilian formal attire for men) one can become critically appreciative of a particularly well-cut example of the general uniform. When the basis of judgement is thus restricted, the weapons of judgement are proportionally sharpened. With a well-established general image in the background of the mind, the example which is at once typical, and more than typical, is readily appreciated as ideally characteristic. This is true whether it be a question of judging terriers at a show, or cathedrals scattered over an ancient kingdom. Now if there was only one peasant, one soldier, one gentleman in a white shirt and a claw hammer coat, one wire-haired terrier, one vaulted cathedral, where would we be? The single specimen might be as good as the best, or as bad as the worst, but how could one make the vivid appreciation which one does make when it is the first among its peers.

Fashion may be regarded as the artificial development of type, at high speed. When a fashion is new it seizes the attention as outlandish. We must needs regard it; but we cannot exercise a discriminating judgement. When it is in full bloom as an adopted vogue, we begin to judge of it with taste; then it is withdrawn and superseded and becomes *déclassé*, just when the lower orders of humanity are adopting it in its more or less degraded manifestations. Fashion is an agency for the destruction rather than for the formation of taste. When, as sometimes happens, the creators of fashion do some real designing, whereof there will be more to say in a later chapter, it is open to them to rank with the best among the creative artists.

The connoisseur is the person who knows all, or enough, about costume, or live stock, or architecture, or what not, to exercise taste within his speciality. He makes his appreciations with respect to new manifestations with the same assurance, but not necessarily with the same infallibility, as he does with respect to the familiar. If he establishes a reputation, and if he gives vent to his findings, he may be readily believed. Those who accept his authority, which may be well worthy of acceptance, then substitute his decisions for the exercise of their own judgement. He may even take a direct hand in the creative field and be a Beau Brummel, a Dandy Dinmont, or a Heliodorus.

3. *The Spirit of the Age*

What of that phenomenon the spirit of the age? There are usually several spirits of several ages all at work, not only at the same time in different parts of the world, but within the boundaries of any given political state. This designation, however, is usually appropriated by the lighter-hearted and lighter-headed elements of society, as applicable to the mood in which the apparatus of its not very important life is contrived. There was a real spirit of its age throughout each phase of Egyptian culture, the same with Greece and Rome and Medieval Europe and the Italy of the Renaissance and seventeenth-century France and eighteenth-century England, to mention only a few of what are called the great artistic epochs. Perhaps the last indubitable, all-pervading manifestation of the phenomenon was in evidence in the United States of America in the middle of the nineteenth century. We hear a great deal about the spirit of our age to-day, but so far, since the Great War, there has been no manifestation of it; only the case where 'old and new battle upon the borders of the world'. When there is a tangible spirit of the age it permeates all that men say and do and write and make and represent. It is easy, of course, to be deceived by associations and symbolism, as perhaps we are when President Lincoln's top hat and President Lincoln's public utterances are seen as having common qualities.

In the field of design there never was a time, or place, in which the interaction of taste and style was more manifest than in Mr. Lincoln's America. There and then steam-engines and spittoons, churches and easy chairs, schooners and skirts were all of a family. There was an exuberant zest in the designing of things as well as in the doings and the sayings. We only congratulate ourselves on having outgrown exuberance and zest, when we fail to accord due credit to the artists and designers of Lincoln's America. This statement is in no sense a plea for the revival of the Lincolnesque.

Now taste, fashion, connoisseurship, and the spirit, or spirits, of an age have their influence on the way everything and anything is said, or done, or made, or represented. These are general aesthetic phenomena that affect all expression, which means all human action. It is precisely because aesthetic, defined as the science of expression, has no limits and must embrace all action that art must be limited to expression with a specific objective and a specific method, if it is to have any meaning at all. This inquiry is concerned with taste and its co-relatives only in so far as they affect that part of aesthetic activity which is artistic.

4. *Style*

Taste, regarded as a function of the recipient, may be said to have its reaction in style, which can only be regarded as a function of the artist. It is a misfortune that the word style, so often on the lips of artists, critics, and the appreciative public, is used in such widely different senses. This has been pointed out, and made the text of elaborate disquisitions, so often and so well that it is only necessary to mention the two meanings here so that the reader may know which is used. In literary criticism, style usually means a characteristic technical quality of the writing of the individual author under consideration—that is to say, a very personal thing; and good style connotes a general standard of conformity to the practice of writers who have something to say and know how to say it. When architecture is under review the simple word 'style' usually connotes a generic characteristic common to the general work of a period. This is due first to the accident that, as heirs to all the ages, we have been very properly absorbing the ideas and words and forms of defunct cultures for five hundred years past; and secondly to the fact that in the case of words the absorption has been more complete than in the case of forms. Thus respectable writers who would never forget that *le style c'est l'homme* in comment upon the work of contemporaries, or predecessors, of their own craft, often regard architecture as an entirely impersonal affair of traditions and retrospective tendencies, and casually classify its efforts under style names. Literature has been, and perhaps always will be, quite as imitative as architecture. If the imitation is less obvious, that is surely no reason for so great an inconsistency in the use of words. In these pages style in design means the selfsame thing that most writers have in mind when they speak of style in literature—a distinctive personal quality. Good style in design, as in literature, involves something of conformity to convention and it always connotes clarity. The competent critic will soon distinguish between the artist who uses Greek forms of speech (or structure) because he has a Greek mind, or the man who uses Gothic forms of speech (or structure) because he has a Gothic mind, and the man who tries to use Greek, or Gothic, forms of speech (or structure) because he has no mind.

Keats and Peruzzi were both endowed with minds as Greek as Hellas itself, and one may wonder whether their contributions would have been the richer, or the poorer, if the one had known the Greek tongue and the other the Greek architecture. William Morris had a Gothic mind and all the advantages of a deep knowledge of the medieval vernacular in speech and in craftsmanship.

Now how can one reconcile what has just been said of style with the suggestion that style, manifest in the artist's work, is a reaction to taste? The patent fact that art does not follow the economic law of supply and demand, but that here the supply creates the demand, would seem to point in a quite opposite direction. Perhaps the difficulty can be solved by remembering that artistic genius is not as rare as it is supposed to be. Nature has a prodigal way with seeds, and it is only those that fall in suitably prepared ground that come to anything; the rest are stunted in growth, or perish. When a community is ready for an artist, that artist can usually be found, just as surely as, when it is ready for a dictator, he is there. It is never so much the case of the artist expressing the spirit of his age, as of the spirit of the age giving the artist his chance. The cults of the few and the culture of the many are both alike symptomatic of the spirit of the age, with their foundations deep in time. Man, as an individual, is not the master of his fate, although he may sometimes flatter himself by thinking so. Artists, after all, are men. The Tuscan race must have produced many Michelangelos although it only once found itself so situated as to give to one a great opportunity. His very foibles of style are in full evidence in the sculptures of at least two Etruscan tombs which he could never have seen. Unrecognized genius is a fact; and genius does not consist in forcing recognition.

5. *Knowledge in Art*

The point has already been made—and it will be made again and again, for it is the main thesis—that art only concerns itself with feeling. Yet nothing could be further from the intention than to assume that this absolves the artist from knowing. It is only out of his knowledge of things—his appreciation of 'the thinghood of things as such'—that he can either derive, or express, his feelings. One may be a first-rate performer in any avocation without being an artist, though most first-rate performers have some artist in them, but one cannot be an artist at all, and through one's works reproduce in others anything of the feelings one has experienced, without being a first-rate performer. That involves knowledge—not the mere technical knowing how of punctuation, high kicking, drawing, painting, or building; but knowledge of what one writes about, kicks about, draws about, paints about, or builds about.

All the skill in the world in the purely mechanical matter of foreshortening is utterly thrown away if there is any misconception as to the shape and size of the thing, real or imaginary, which is shown foreshortened—even if the thing is just the boom of a boat in a fog. And all the knowledge or imagination in the world about boats and booms and fogs and the sea on which fogs descend, will be just a display of knowledge, or imagination, concerning such things and not a work of art, unless the performer can put spirit, or mood, into his boat and his fog and his sea. If he can do this, he is an artist as well as artificer. He cannot be artist only. Mood is inexpressible without form; and form, however imaginary, must be made up out of experience. 'Nothing, not once in sense, can be in memory; far less in imagination.'

This hard saying may become abundantly clear if we pursue the matter a little farther. If there is artist as well as knowledgeable performer in the delineator of that boat, he may drag us through his canvas right out on to the Atlantic and drench our very souls in brine and fog. Or, equally artist, but one who prefers the ocean of Faerie to the Grand Banks, he may send us floating and dreaming on the seas of time in a haze that never was by land or sea. But he cannot do that if his imaginary wind blows his imaginary water and pennants one way, and bellies the sails in the opposite direction, while the ship of his fancy is so high out of the water that she could only float on her side. Both she and the waves and the wind may be fantastical, but they must be plausible—based on experience; not on ignorance.

And so it is with writing and design, even when the feeling is not incidental to the fact, but the fact incidental to the feeling. The fact, however imaginative, must be based in the reality of experience. The people must be capable of breath if they are to be endowed with speech; the abutments must be capable of resistance if the arches are to carry a wall. Negation is not imagination. Jerome K. Jerome long ago showed a just impatience with the kind of originality that fits feet to the wrists and hands to the ankles. Pegasus demands an anatomy.

6. *Professionalism*

Here a moment's attention must be given to yet another problem of aesthetic; that of professionalism. The writer once had occasion to advise a professional poacher and 'guide' to leave the woods and work on his farm in the interest of his wife and a numerous offspring. 'And am I, who knows so well how to follow the tail of a caribou, to be content to follow the tail of a plough?' That, with a shrug of the shoulders, was all the reply.

It is the same with the artist. If he needs must, he risks starvation as a professional for the privilege of living what is after all the spiritual life, and expressing what he feels. And some professional artists do very well and live on the fat of the land; but at their peril. The full cellar may be an obvious aid to the establishment of connexions and opportunities. A hard head may serve a like purpose. Yet a poor larder is, after all, the great stimulus to the mastery of knowledge and technique.

The pride of the professional is a little illogical. Like the front line soldier, he feels his worth should be measured by the risks he takes; and, if he gains a living at all, by the fact that he does so. In reality it is the wolf at the door that he usually has to thank for the industry that so often gives him an advantage over the amateur. In natural gifts many an amateur far excels the average professional who lives by his art. Inherited wealth has robbed the world of many a great artist.

With the snobbery that seeks to make distinctions between the fine arts and the industrial arts one can have no patience. The true distinction is between the artificer and the artificer who is artist as well. The 'work' that appears within the four sides of a gold frame on a wall and the work that stands on its four legs beside the fire are often equally worthy of the designation 'industrial art', which means that there is no art there; and sometimes of the designation 'fine art', with all that that implies of a person, somewhere in the case, who gave something for which he could not and did not expect to be paid in coin of the realm, or any legal tender. For him it is enough, and more than enough, that you acclaim him artist, or feel what he felt and say nothing about it.

The artistic temperament becomes easily explicable once one realizes that, even to-day and even in Chicago, there are persons, willing enough to take what the gods may send in the way of cash, yet utterly incapable of considering quite seriously any currency but that of the heart.

7. *The Artist Critic*

From time immemorial religions, in their various manifestations, have professed to show the way to the spiritual life. Many of them have been abundantly successful in implementing their promises, for a time at least. Now in the New Testament there is a saying of Christ touching on this matter in a most direct and practical way. 'Except ye become as little children, ye cannot enter into the Kingdom of Heaven.' This is no place to argue whether the Kingdom is here or hereafter, or to support the thesis that aesthetic amply explains religion. Nor need one chop logic as to whether spiritual life can be led without religion at all, or as to the rival merits of the forms of belief in this connexion. Few will quarrel with the identification of 'the Kingdom' with the place where the spiritual life is led. It is, however, the use of the word 'children' that is of interest here as the key-word of a cogent phrase.

Knowledge of the arts is very apt to erect a screen between the technically proficient and the work of art. There are so many technical matters in any work of art which appeal strongly to the interest of the technician. The young technician is particularly vulnerable in this respect. He is a student, and, try they never so hard, it is only in the realm of technique that his instructors can do much for him. The ripe critic knows well when to dwell on technique and when to sweep it aside and look beyond it. But most artists only become ripe critics as the inevitable prelude to decay. As long as they are active they are obsessed with their own technique, and vastly interested in the technique of others.

Now it is one thing to be able to realize what is art and what is not art, what is theme and what is content, what is technically right and what is technically wrong—all on general principles. It is quite another thing, with a work of art before one, to apprehend what the artist is doing to one through words, or paint, or stone.

If art criticism means anything, it means an admission of what has been done to the critic, by the artist, through the work of art. Nothing that matters can be done to the critic so long as he excites himself about brushwork and composition and authenticity, except a stimulation of his mental processes with respect to such-like matters. And so long as he excites himself about what is represented, or stated, in the work of art, very little can happen to him, beyond the acquisition of knowledge.

He may get nothing else out of the work of art (we are assuming that it is indeed a work of art) because of some defect of sympathy; but supposing that he and the artist have enough in common so that it is possible for the artist to make him feel the way the artist has already felt, then that can only come about through contemplation pure and simple, without theorizing and seeking for information. That is to say, the critic must make his approach in the spirit of a little child with an eager open mind.

There are thus two quite different ways of approaching a work of art of any kind whatsoever. It is well to distinguish them clearly. If one is not sufficiently master of one's soul to let oneself go and be carried away at will, or on the other hand to wax inquisitive and analytical, at will, then one should at least seek to be master of one's mind sufficiently to know what one gets out of a picture as brushwork, as composition, as mill or madonna, and, as what it was painted for, MOOD.

IV

THE NATURE OF COLOUR VISION

1. *Understand the Eye*

THE study of aesthetic activity must inevitably take into account the functioning of the organs of sense, because the senses are the direct avenues of expression. The physical work of art does not only stimulate sense energetically, but has to stimulate it agreeably, as a prerequisite to the admission of its clamorous content to the attention of the mind for recognition and appreciation. It is therefore proposed, before approaching the technicalities of the art of design, to direct some thought to the nature of the eye, by far the most intricate of the organs of sense. It is through the eye that design appeals. And lest an amazed interest in the 'staggering complexity' of this organ should unduly warp our judgement as to its precise functional value when a work of design is under observation, let it be understood from the outset that what is seen through the eye at any given moment of its incessant wandering is but a fragmentary collection of signs and tokens; and that a well-furnished mind is an essential for the filling out of the details. There is skill in seeing as well as in the making of things to be seen, and both are dependent in very large measure on mental residues of past experience.

The question of whether the kinds of drawings of buildings which architects on the one hand, or painters on the other, are prone to make, are the more effective as physical aids to representation of the original object has an interest in this connexion. The architect draws what he knows is there, and a good deal more than he can see, while the painter is apt to misinterpret minor details in his effort to present the reality of common experience, rather than the reality of fact. As design, and not graphic art, is under consideration, this point need not be laboured beyond observing that the methods of representative art throw some light on the phenomenon of intelligent observation. The fuller measures of ability to enjoy things seen connote a complementary ability to represent what interests.

Perception of form and perception of light and shade and colour are hardly to be separated in actual experience outside the realm of experiment. Although the same organ is involved in both, the mechanism and synthetic processes involved are widely different. As the problems of colour vision, complex though they be, are not only simpler but have been scientifically investigated to a far greater degree than the problems of form vision, the latter are reserved for discussion farther on.

The most direct bearing of colour vision upon design in the large is in connexion with the juxtaposition of materials differing in colour. Such juxtapositions may be structurally inevitable and natural, or again they may be intentional and artificial, but it very often happens that where such juxtapositions are involved there may be some latitude of selection; the designer is none the worse equipped for his task if he has clear ideas on such matters as contrast and harmony, which can only be explained by reference to physical, physiological, and psychological data. Of course there is as much to be apprehended about the use of colour by playing with a paint-box as by reading up the physics of light, the physiology of the eye, and the psychology of imagination, but the agreeable and valuable paint-box exercise is apt to be misdirected in the case of those ignorant of first principles, or suffering from such antique and exploded theories as still cling about those schools of art where 'art' is understood to mean painting in oils.

2. *Limits of this Inquiry*

The inquiry in this chapter makes no pretence of adding to the sum of human knowledge on the difficult subject of colour vision. It seeks to collate, in simple form, and to summarize what is now well ascertained, and thereby assist in the dissemination of knowledge. It also seeks to derive (from what is known of these matters and in the light of the general aesthetic theory propounded) something in the way of an explanation of our hedonic reactions to the phenomena of colour sensation. Not that a knowledge of such matters is really essential to an artist's equipment, but in these days there is so much bad science and worse aesthetic peddled about with charlatan assurance, that a little weighing of probabilities, facts, and fancies is in order. The purpose of this chapter is thus to ascertain, not only the main facts of colour satisfaction, but the possible causes. Hedonic reaction is the instrument of aesthetic activity, or, if you will, the handle of the door between the mind and the universe of things, with other minds among them. We seek some answer, even if it be but an imperfect one, to the question 'How is the pleasurable associated with experience of colour?'

3. *The Physical Basis of Light*

To the physicist light is that part of a series of waves of disturbance due to radiating energy derived from incandescence, and varied in length and amplitude, which, passing through space, impinges on the retina of the eye to provoke in the mind sensations, more or less quantitative, of colour.

This entire perceptible series is conceived as infinite in gradation and capable of simultaneous movement at a uniform rate of 186,000 miles per second in space, with slight modification of uniformity and speed in other media.

The wave-lengths we are concerned with in the spectrum vary roughly in a ratio of 1 to 2. The shorter produce the violet and blue sensations and the longer the red and orange ones, while the green and yellow sensations are the result of waves of intermediate lengths. Measured in millimetres these wave-lengths occur from the fourth place of decimals and are thus readily seen to act within the sphere of photochemical action and not of direct sensation. The wave-lengths for a red (at A) near the end of the spectrum is 0·000759 millimetres, and that for a violet (at K) near the other end is 0·000393 millimetres.[1]

The corresponding numbers of oscillations, measured in tens of billions per second, are 3,960 and 7,630, a ratio of about 1 to 2.

It may be mentioned along with these dimensional data that the eye is sensitive to an extreme range of from 1 to 2,000,000, the difference between the strength of light on a starlight night and tropical midday sunlight.

Then again, spectral colours vary in the luminosities proper to each, and, in sunlight, if yellow (at D) be taken to represent 1,000, a red (near A) can be found with a value of about 100, and a violet (near K) with a value of 10.

A comparison of these dimensional characteristics of light waves with the infinitely grosser scale of sound waves should be sufficient to discourage once for all the use of analogies between aural and optical sensations.

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[1] (At A), (at K), &c., refer to certain fixed lines in the solar spectrum convenient for reference.

Such words as 'harmony' and 'discord' may be applicable to each in virtue of common character in hedonic reaction, but mean nothing, and express less, when applied to the respective sets of physical stimuli for the physiological organs concerned.

The frictionless nature of the medium in which these 'waves' of energy travel disposes of the problems of loss of energy which the analogy with waves on water is apt to provoke in the mind.

Perhaps the most difficult conception in the above brief summary of current hypotheses is the simultaneity of the movement of the whole series; but it is the interferences due to this rather than the wavelengths themselves that must be regarded as the direct stimuli of the varied series of sensations experienced. When this entire series, or an approximation thereto, is involved, the corresponding sensation is white light, weak or strong, depending on amplitude.

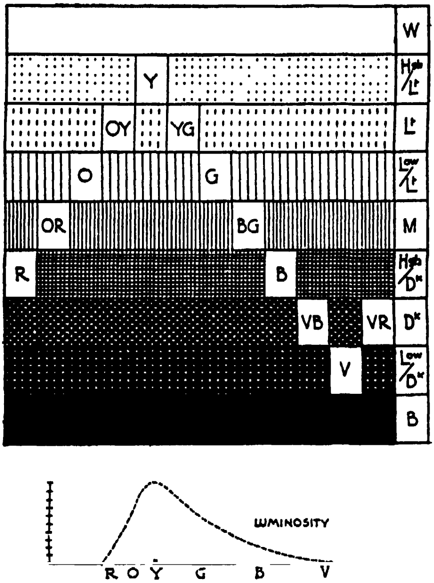

FIG. 1. Twelve hues on a scale—white, high light, light, low light, medium, high dark, dark, low dark, and black—showing approximate luminosities.

(After Professor Arthur Pope's diagram.)

A beam of sunlight is made up of this whole series and can be decomposed by means of a prism, or diffraction grating, into a spectrum seen as a graduated band of colours, certain of which have become prominent (through the functional evolutionary process) as sensations of red, orange, yellow, green, blue, and violet.

These, together with purple (i.e. violet-red, a constructed colour, resulting from a combination of elements from each end of the spread-out beam or spectrum) and the many intermediate colours which can be recognized by descriptions in terms of two adjoining colours of the six named, are what the normal and intelligent experience. They will henceforth be referred to as hues. Any limited section of the spectrum which appears homogeneous can be named a hue. A trained and sensitive observer may readily distinguish several scores of such sections (with the purple group included). A reference diagram of twelve or sixteen hues will usually be found sufficient to refer any conceivable colour to its place within the spectral series of hues.

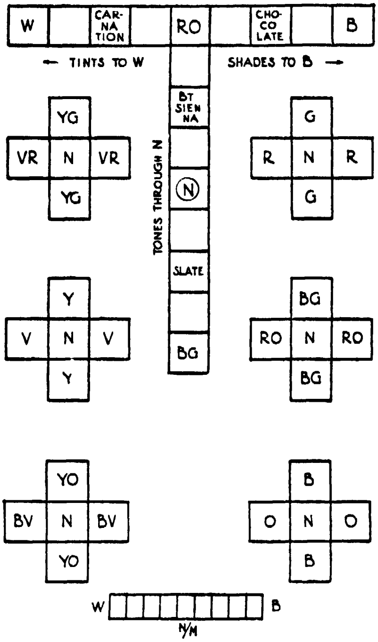

FIG. 3. Red-Orange is here shown neutralizing through tones with Blue-Green and modified through tints to white, and through shades to black. Grey appears at the point where RO and BG fully neutralize (at 'medium' neutral in this case). Other neutralizing pairs are shown by crossing bars of complementary hues.

Much confusion arises in the loose application of the nomenclature of colour sensation in speaking of physical causes on the one hand, and in reference to pigment mixing on the other.

White light may be considered as running all the way from zero intensity (black darkness) up through dark grey light, medial grey light, light grey light, to 'standard white light' (average Washington Sunlight) into blinding white light, where vision becomes impossible. Besides, for every degree of white light there is a full spectrum of saturated hues at appropriate luminosities. (These luminosities of hues within each such spectrum are not uniform of course.) Thus hues may vary in luminosity while retaining full saturation.

For every degree of luminosity of the parent white light a true tint may be constructed out of a hue plus admixture of white light. This true tint can then go up and down the scale of luminosities till the eye fails to distinguish it from white at the one end, or from black at the other; just as is the case with saturated hues.

Any colour sensation can thus be defined in terms of hue (spectral position), luminosity (correspondence with a degree of

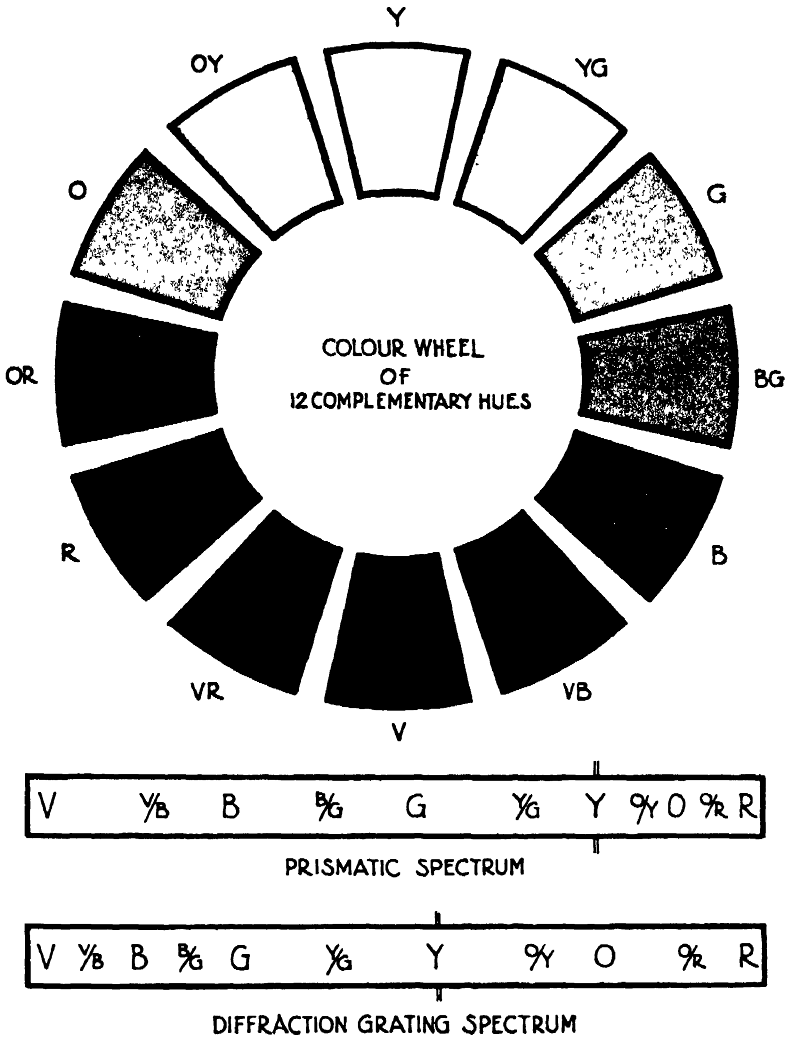
Y
YG
G
BG
B
VB
V
VR
R
OR
O
OY
COLOUR WHEEL
OF
12 COMPLEMENTARY HUES
V V/B B B/G G Y/G Y O/Y O O/R R
PRISMATIC SPECTRUM
V V/B B B/G G Y/G Y O/Y O O/R R
DIFFRACTION GRATING SPECTRUM

Fig. 2. A chromatic circle of twelve hues. Each hue is complementary to that opposite. Such pairs neutralize.

Note variation in spread of hues in the prismatic and diffraction grating spectra.

whiteness), and saturation (degree of characteristic when compared with a grey of equal luminosity).

But when we seek in a practical way to designate any colour resulting from elements of light reflected from pigmentation it is advisable first of all to ignore light too strong or too weak to see by. It is only, after all, in what the scientist calls a grey light that the eye discriminates between nearby hues. Any such colour may then be designated with reference to:

1. Spectral position determining *hue.*
2. Admixture with complementary hue determining *tone* (towards neutralization).
3. Admixture with white determining *tint* (up to white).
4. Admixture with black determining *shade* (down to black).

In the case of admixture with white the hues are shifted towards the ends of the spectrum dividing right and left from the yellow which is not affected. A tint of a shade and a shade of a tint amount to the same thing; which is designated as a *broken tone.* This is to be clearly distinguished from a true tone; for the luminosities of true tones are controlled by the fact that complementaries do not neutralize at any arbitrary luminosity. Certain pairs neutralize at a medial grey, but others (yellow and violet for example) far above it. A scale of broken tones of a green hue and a scale of true tones of the same hue will thus only match at one point.

Actually, completely saturated colour, and therefore absolute tints and shades, can rarely be experienced in nature; but many dyes and flowers, and skies occasionally, yield colours in which the degree of neutralization they suffer may be ignored and these may be classified as tints, shades, and full hues.

Colour sensations derived from transmitted light are not so easily defined. In the case of reflected light the physico-chemical constitution of the coloured object is such as to absorb all the constituents except those reflected, but in the case of transmitted lights producing various colour sensations the light may be stained by an excess of one or other hue, as is often the case when lights derived from two sources play on an object—say a white light and a pure red light. This is a mixed or tinted light. The pure red light is a hued light. There are also lights deficient in one or more hue elements and these again may be mixed with white light, but even if unmixed with white light they may be quite intense in virtue of high amplitude in the waves concerned. The word 'shade' is hardly applicable to such lights. In stained glass these are of frequent occurrence and may well be described as tones, in the sense used above.

Suppose a homogeneous *red-hued light* and a light composed of white light plus red-hued light, which we may call a *red-tinted light*, and a light deficient only in blue-green elements, which we may call a *reddish light*, to play in turn upon a sheet of white paper and a polychrome object (such as a painted representation of the solar spectrum), what will be the resulting sensations to the eye accommodated to see with white light?

With the *red-hued light* the white paper will look red at first (and become white by adaptation) and the red in the painted spectrum will behave similarly, but the blue-green will become black, other colours shifting in appearance towards red.

With the *red-tinted light* the white paper will look reddish at first, and change as before, but the red in the spectrum will retain redness and the blue-greens will be neutralized to grey.

The *reddish light* will affect the white paper much as the tinted light did and so also with the red, but in this case the blue-green will show black as in the case of the red-hued light.

Certain colour sensations, the purples, are due to mixed light of two hues, and the others, including even yellow, can be stimulated either by mixed lights or by a light of spectral purity. When it is borne in mind that objects capable of reflecting hues or mixed lights are in the vast majority of cases illumined by changing tinted or toned lights, it is not to be wondered at that alarming changes are of frequent occurrence. That is why mural paintings should be executed *in situ* and worked on by both natural and artificial lighting.

Light of fully saturated hue only occurs in laboratory experiment, but approximations to such lights are used for stage effects, often disastrously, resulting in jet-black lips and grey or purple cheeks and the like incongruities.

It is easy to make up a series of four shades towards black, four tones towards grey (obtained by neutralization with a complementary), and four tints towards white, all developed from a spectral red hue. The system on which colour nomenclature is based can also be illustrated by the verbal equivalents of the several shades, tones, and tints. Thus, a dozen or more distinct colour sensations may readily be derived from one hue. The student will find the preparation of a diagram of a dozen derived colours, with a table of nomenclature for each of a dozen hues selected from the infinite spectral series, a useful exercise. Yellow, for instance, would give amber among its tones, primrose among its tints, and olive among its shades.

4. *The Eye and the Mind*

It will be well, before proceeding to the consideration of the relations of colour sensations and the effects of variations in colour characteristics, to describe briefly some of the functions of the several parts of the organ of vision and its share with respect to the mind in the formation of these sensations.

The eye has been most aptly described as 'a wonderfully compact little instrument, capable of being focused at any distance from five inches upward, provided with the only original iris diaphragm, and having the special feature of a self-renewing plate which automatically alters its sensitivity to suit the illumination, and also gives coloured photographs. This camera cannot, however, be guaranteed, as some specimens are defective, and even the best are liable to be injured by hard usage; none will be replaced, though some of the defects can be partially corrected.'[1]

The retina, or self-renewing plate of the 'camera', may be described as follows: In the most sensitive central part of this apparatus there is a nerve structure, known as the 'cones', surrounded by an area in which cones also occur, but mixed with the 'rods'. These rods are stimulated by light to produce and distribute the liquid visual purple, and the ends of the cones are in turn stimulated by the photo-chemical decomposition of this visual purple by light, whereupon a visual impulse is set up, which is conveyed to the brain. The character of the stimulus, the impulse, and the sensation (which is a function of the mind, not of the eye) is conditioned quantitatively by the strength or amplitude of the waves, and qualitatively by the approximate lengths of the waves transmitting the form of energy to which the organ is sensitive, the results being the sensations of light and of colours respectively.

It is accepted that 'the ordinary reaction of the retina is alkaline; this is changed to acid by the action of light'.[2]

It is perhaps significant that a 'Universal Indicator' fluid made up with hydrochloric acid and caustic soda is on the market. 'When a few drops of it are added to any sample of water it changes the colour of the water upon a scale varying from red through orange, yellow, green, and blue, to violet and purple, according to the degree of acidity or alkalinity present, and due to hydrogen ion or hydroxyl ion concentration.'[1]

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[1] Ladd and Woodworth, *Phys. Psych.*, p. 196.

[2] Edridge Green, *Physiology of Vision*, p. 46.

In front of the sensitive, self-renewing plate the eye is constructed generally after the manner of any optical instrument (for all of which, indeed, it has served as the model) with a lens element and adjustments for direction; but in place of the group of lenses controllable as to distance for focus, with which we are familiar in artificial mechanisms of this nature, the lens of the eye is itself elastic and yields to muscular control. The image of the object regarded is thus defined upon the retina in terms of reaction to amplitude and length of waves (i.e. light and colour stimuli) by beams passing through the centre of the lens, and falling on the more sensitive area about the centre of the retina.

Seeing is done by directing the organ of vision at an object, either on the prime initiative of the owner of the eye, or by his passively allowing the organ of vision to be attracted towards any object stimulating the attention through contrast with its surroundings, whereupon automatic action follows, possibly leading to initiative. In either case the organ of vision picks up fragmentary and transient images in rapid succession which the mind busily reconstructs by virtue of past experience derived through all, or any, of the senses and then projects this experience into space. Initial experience of the objective world is probably never obtained by one sense acting alone; this, by the way.

Thus, my experience of mahogany writing desks, of William and Mary, and of reflected lights and shadows, all enable me on glancing up from my work-table to translate an optical pattern, or figure, in various deep shades based on orange hues (that is, mahogany browns) sprinkled with spots and blurs in tones based on blue-green hues (that is, reflected high lights from the green trees and blue sky outside the window) and blotched at regular intervals with tints based on yellow hues (that is, golden lustre of brassware) into the cherished possession of an ancient writing desk. Without the intuitive knowledge of things as they are, I might mistake what I actually see for a wild animal, be merely puzzled, or only just

[1] W. Rushton and F. G. Richmond, *Trout and Salmon Magaz.*, no. 33, p.289.

aware that brown and broken grey and some yellow-coloured light was reflected over there, all without of course knowing or caring what light was, or how reflection took place. Perhaps there is a spot on my retinal image of the desk! Has something gone wrong with my eye, or is it a speck of white paint, or can it be a bruise catching light on the surface? I am interested and approach to see what the spot may be, with thoughts of how it came there, and it flies away to the window, whereon I reconstruct it, wings, legs, eyes and all, for I now know it to be a mosquito.

Later on the satisfactions and pleasures derivable from seeing things, usual or novel, and recognizing their colour elements must be investigated. Here it need only be pointed out that by projecting those shades of orange, tones of blue-green, and tints of yellow with paint on paper and in the several shapes, or figures, in which I am conscious of them, other people with experience of William and Mary writing desks, or things of that kind, can be induced to recognize what it was I saw and recorded.

It is thus clear that not only colour perception as such, but the perception of objects through the differentiation of the colour sensations corresponding to the several parts of their retinal images, is a function of the mind. Sight is a sense which does not perceive reaction to stimuli as in the organ involved, as is the case with touch and taste, but as projected into space. It is, moreover, very doubtful whether colour can be conceived as wholly independent of objects reflecting or transmitting it. If one thinks of any particular red, it must necessarily be as the kind of red one saw or would like to see in a flower, or a vase, or a dress, or a sky, or a wine, or a church window—a red sensation which, occurring as in a particular object, was approved or disliked in connexion with that object. The mind cannot delight in, or abhor, colour *per se*; far less can the eye do so. To the eye, then, colour and colour-schemes are indifferent, except in so far as functional inhibition and fatigue may be involved or engendered. To the mind, colour is inseparable from objects, even if the object be but the unexciting inside of an optical instrument. But there is appreciation of colour as apt, and disapproval as inept, with respect to object and circumstance. Where colour combination is involved, the talented or trained mind may be acutely sensible of approbation, or of dislike. This is not a matter of atavism or cultural habit simply, for those with a developed colour sense readily recognize with delight scheme and unity, where such exist, in colour combinations of the most unfamiliar, exotic, or novel kinds. There is probably more consensus in this than in any other elements of matters of taste. At a later stage of this inquiry, and after an account has been given of various colour phenomena, the question of the nature of those colour combinations that satisfy and those that fail to do so will be discussed. Henceforward the word colour without the suffix 'sensation' is used, remembering it to be a function of mind.

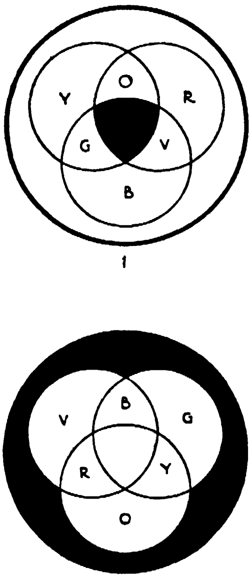

FIG. 4. Three hues, equidistant on the chromatic circle, generating three secondary hues: and combining as black (in the case of pigments).

Three hues equidistant on the chromatic circle generating three secondary hues; and combining as white (in the case of coloured lights).

NOTE: A secondary yellow, constructed from primaries of lower luminosities, is: in the case of pigment, a brown; and, in the case of lights, a yellow equal in luminosity to the combined luminosities of the ingredients.

5. *Colour Charts and Colour Names*

The student seeking enlightenment, as distinguished from mental gymnastics, is warned to treat with caution those works on colour theory in which the familiar diagrams of three interpenetrating circles occur. This decorative pattern is to be regarded as a rhetorical formula rather than as an argument. From a collection of half a dozen, all of recent date, now before the writer, one gathers that the intention, in each case, has been to provide a mnemonic to illustrate the fact that two near end elements of the spectrum and the middle portion will produce white light and that the mixture of any two of these hues is the complementary of the third; also that these complementary pairs are adequate to produce an indifferent whitish light when mixed. All this is readily admissible. Further, it is usually implied that by appropriate mixtures of adjoining members of the primary three a complete set of saturated hues can be constructed. This cannot be accomplished by means of pigments. A fair approximation can be made by mixing coloured lights of the standard three 'primaries' (violet, green, and a red which might well be designated orange) plus some white light. The feat can be done, however, with pigments to a close approximation when four 'primaries' are allowed: yellow must be one of them, the others being orange-red, violet, and blue-green.

It happens that colour nomenclature is, from the nature of things, vague, and that printers' inks are, from similar causes, a little impure as to hue, and perhaps scientists as a class have in the past been a little blunt in the finer perceptions of colour, and a little zealous to demonstrate that what their hypothesis might lead one to expect is so. Thus the identical colour occurs in some of their diagrams as a primary 'blue' and in some as a secondary 'blue', and the word 'blue' and the word 'violet' occur in others for the identical 'primary' used as such. These victims of symmetry seem to forget that the spectrum is not a circle but a bar, and when they add purple (VR) and dispose the bar around a circle, the arbitrary amount of space they allot to purple may upset the adjustment. Thus, one writer finds blue opposed to red, another finds green, while the consensus of opinion is that blue-green is the complementary of the particular scarlet-red both happen to employ.

By these means, in one case, an orangey (alleged primary) red is made to oppose an ultramarine blue (secondary), with an unexceptionable yellow (primary) opposing a purplish violet (secondary), and a yellowish green (primary) opposing a crimson (secondary), while in another the same dubious red opposes a blue-green called blue, the same yellow opposes a true violet, and a very cold green opposes the same crimson called indifferently 'purple', 'pink', 'magenta', and otherwise identified by another writer as 'rose'. The circular colour chart can, at the best, be only a very rough approximation.

Considerations derived from the inspection of the spectrum in line and the evolution of the colour sense confirm the empirical fact that white light can be produced from selected parts of the spectrum as well as by recombining the whole bar into a beam of light. Such constructed 'whites' can have only the combined luminosity of their components. Thus white can be produced from a *quartette* of selected blue, green, yellow, and a red, not quite at the end, and from the triad violet and red from the two ends and a green near the centre, and from the complementaries of this triad yellow, blue-green, and purple, and from such *pairs* of complementaries as have been indicated above, and intermediate pairs. When the spectrum is conventionally laid out as a circle (with the purples added) instead of as a line terminated at the red and the violet, it is in order to place complementaries *vis-à-vis.*

It is to be borne in mind that although certain elements of the spectrum enjoy a prominence best accounted for by the historic evolution of the colour sense (but possibly in a measure due to the frequency with which certain highly saturated colours are experienced in nature—blood red, orange yellow, lemon yellow, grass green, sea green, sky blue, iris blue)—there are really as many units as the person seeing can distinguish, each of which is a hue. It will then be realized how arbitrary it is to conceive of any selected triads as primary and to erect theory and practice thereon. In truth the fixed triad of primaries was invented to support attempts to reconcile an ingenious but obsolete theory of colour vision with an as yet unperfected knowledge of spectral phenomena.

It is often stated that extreme contrasts of hue are derived from complementaries, but consideration of the nature of the spectrum at once reveals the fact that the ends of the spectrum provide the extremes. All others are less violent. Some, realizing this, but insisting that complementaries are extreme in contrast, oppose these end hues, and so distort their diagrams. Complementaries are inevitably unstable, as the different hues do not react homogeneously to reduced or increased illumination.

Colour sensation is a very relative affair, and in considering colour combination it will be brought out that a given stimulus can be made to shift its sensation many degrees on the chromatic circle. Our seeing apparatus is far more sensitive and discriminating as to difference in hues present than as to their identification by name, or through memory.

What an investigator elects to call red, or blue, has too often depended on the spacing adopted on his circle (whether ranged by prismatic or diffraction grating and the allowance made for the purples), not a little on the stains, dyes, pigments, or inks employed, and sometimes on the qualities of the 'white light' in which diagrams have been prepared.

As the yellow band is narrow and well defined by very high luminosity, its complementary can be easily established and will be called blue, violet, or even purple by people meaning the exact same thing matchable between ultramarine and smalt. It is convenient to divide the circle in two by a diameter traversing these hues. The 'hot' side will then contain the red group, and the 'cold' side the blue-green group.

The following table of colour names may be found convenient, if not for general use, at least for what follows. The division of the chromatic circle into twelve has the advantage that both triads and quartets are ready formed.

Abbrev. Name	*Usual Hue Name*	*Ex. of Tint Name*	*Ex. of Shade Name*	*Ex. of Tone Name*	*Approx. Pigment*
VR	Violet-Red (constructed)	Lilac	Plum	'Lies-de-Vin'	Purple Madder
R	*Red*	Salmon	Maroon	Sepia[1]	Alizarin Scarlet
RO	Red-Orange	Carnation	Chocolate	Burnt Sienna[1]	Scarlet Vermilion
O	*Orange*	Cream	Vandyke Brown[1]	Buff	Cadmium Orange
OY	Orange-Yellow	Ochre[1]	Raw Sienna[1]	Drab	Cadmium Yellow
Y	*Yellow*	Primrose	Olive	Amber	Aureolin
YG	Yellow-Green	Lemon	Sage	Apple	Sap Green
G	*Green*	Nile Green	Pine	Jade	Viridian
GB	Green-Blue	Turquoise	Blue-Black (Ink)	Slate	Cerulian Blue
B	*Blue*	Sky Blue	Navy Blue	Smoke	Antwerp Blue
BV	Blue-Violet	Periwinkle	Indigo[1]	'Horizon Blue'	Ultramarine
V	*Violet*	Heliotrope	Grape	Mauve	Smalt

[1] Pigment names in default of others.

It will be observed that many pigments of high spectral purity in common use would occur midway between the names of those corresponding to the twelve hues derived from this spacing on the chromatic circle. In the columns of tints, shades, and tones the names derive chiefly from flowers, fruits, and stones, while some are fantastic but quite clear in meaning. All browns can be classed as shades or tones of yellow, orange, or red.

All that has been said thus far on colour vision is merely designed as preliminary to the investigation of the enjoyment of colour, both by the controller, or composer, of a colour scheme and by those who experience it.

V

THE APPRECIATION OF COLOUR

1. *Phenomena of Colour*

MUCH still remains to be done, not only to reconcile divergent studies, but to fill the gaps in our knowledge. The serious student is advised to consult only recent scientific publications and to be ever on his guard in the matter of nomenclature. Most young ladies still use the word 'shade' and many old scientists still use the word 'tone' for what modern writers on the artistic aspects of the colour problem call 'hue'. From what has already been said, respecting our present knowledge of the physical nature of light, of the visual organ as an instrument for the differentiation of colour stimuli, and as to the functions of the mind in the perception of light and colour as elements in things seen (stimuli projected by the mind in space), it may be inferred that colour recognition is a relative affair. The 'standardized white light' pigmentation, or actual local colour of the object seen, the quality of the light illumining it and the juxtaposition of other objects differently pigmented, or even the mere presence of light of other quality affecting other objects within the visual field, are all elements in the resultant colour which the beholder ascribes to an object. The nomenclature of colour has consequently always presented difficulties, and the root words of colour change their significance with the generations, as every schoolboy knows who has struggled with his *Georgics*. Nor are the modern masters of English literature much more concise in their phraseology. Scientific writers within the last generation, as we have seen, have been wont to vary the meanings of colour words with cynical disregard for their predecessors, their contemporaries, and their readers. A review of the more commonly accepted meanings of the colour words current among investigators and artists, some of which have already been illustrated, is necessary at this point.

HUE designates the location on the spectrum (or completed spectral circle) of any colour;

Ex.: Vermilion and chocolate are identical in hue, so are the colours of a sapphire and of a chicory flower.

TINT signifies variation from the saturated colour as found in the spectrum by the admixture of white light, or a pigment reflecting white light.

Ex.: The chicory-flower blue is a tint of the sapphire blue which is more saturated or 'deep'.

SHADE indicates variation from the saturated colour by the balanced addition of all the other pigmentary colours, including itself, i.e. black, or in the case of light by a reduction of strength or luminosity.

Ex.: Chocolate is a rather dark shade of the hue fairly represented by vermilion when the hue is saturated or spectrally pure.

TONE, which, with some of its derivatives, such as 'tonality', is frequently used where 'hue' is meant, is preferably used as signifying variation from the saturated colour (or a tint of it) by neutralization, or conversion towards grey, and properly speaking is only applicable to pigmentary colour.

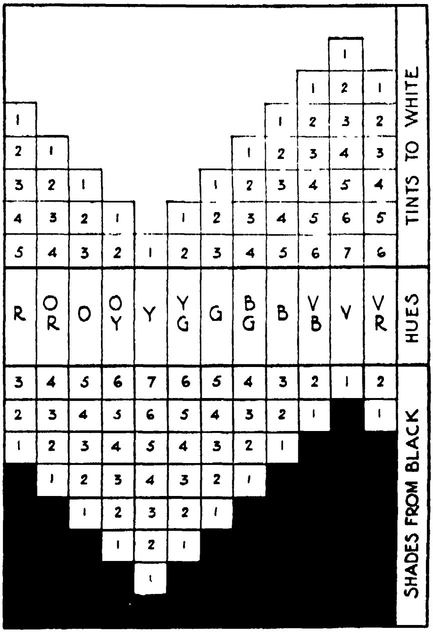

FIG. 5. Twelve spectral hues in line. Their luminosities determine the number of equally separated tints and shades of which each is capable. Blue-Green and Orange-Red can have as many tints as shades. Violet admits seven times as many tints as shades; and Yellow admits of seven times as many shades as tints.

(After Professor Arthur Pope's diagram)

Ex.: Scarlet, a nearly central red, and its complementary blue-green can be mixed through a series of tones, a neutral grey being the central resultant. If corresponding tints of these colours are involved, such as salmon and turquoise, the resultant grey will be correspondingly lighter. So long as the scarlet (or salmon) on the one hand, or the blue-green (or turquoise) on the other, predominates, the series of tones maintains its hue. Adding grey is not the same as neutralizing with a complementary. The result of that procedure is a change of hue. Tones involving mixtures of grey are often spoken of as 'broken tones', a convenient phrase.

Complementary Hues may be defined as pairs, which, on being mixed, neutralize each other, i.e. with pigments they produce the effect of grey, or, with coloured lights, a lowered white light, equal to their combined luminosities. Each such pair of colours is also spoken of as antagonistic, or balancing. When complementarily coloured areas of high saturation are placed in juxtaposition, the eye is flooded by both, and, contrary to current precept, there is loss of both luminosity and saturation—each soils the other. But the juxtaposition of two areas of broken tones or tints, or even shades, complementary in hue, produces a totally different effect as in such cases there is an illusion of enhanced purity or saturation in each.

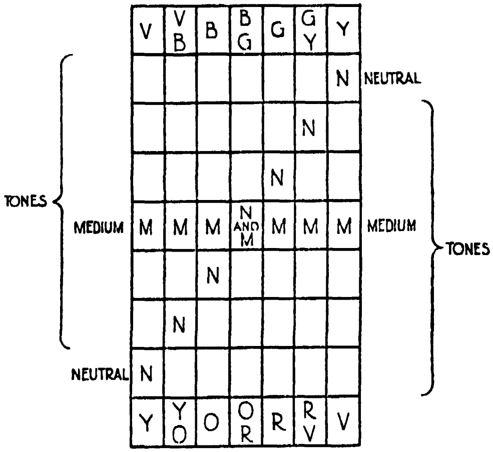

Fig. 6. As soon as neutralization begins there are tones; but the neutral tone is only at medium, half way between black and white, for the Orange-Red and Blue-Green pair.
(After Professor Arthur Pope's diagram)

Ex.: The general avoidance in the flags of the nations (in which strength of colour and the distinction of character are fundamentals of design) of actual complementaries, and the addition of white when complementaries are involved, illustrates the case against the use of saturated complementaries.

Ex.: The bloom of a flesh-coloured carnation, and the leaves of that flower, are tints complementary to each other, and mutually enhancing.

Colour Flooding, above alluded to under complementary hues, is very pronounced in the case of saturated colours selected from either of the end regions of the spectrum—the red-orange and the blue-violet groups—when placed in juxtaposition with white. Large areas of any highly saturated colour will tend to obliterate small areas of equally saturated complementaries.

Ex.: White letters in poster work may be observed to be tinged with cream or pink when on a bright red background, or with pale blue or heliotrope when on a bright blue one, and so on.

Ex.: The human eye, which at best is but a mottle of bluish or brownish shades, one or other predominating, will 'take colour' in a most marked way from a dress of its predominating hue, provided this be fairly saturated. So does the complexion. A lady's blue, or violet, eyes may be largely the result of a bright blue dress, and any man will look sunburned in a strong tan-coloured suit. When tints, or broken tones, are used in dress the result is quite different, and enhancement of eye or face colour by simultaneous contrast may occur. Green continues to provoke simultaneous contrast even when fairly high in saturation. That is to say it does not 'flood' strongly.

Simultaneous Contrast is most marked when the hues involved are referable on the chromatic circle to positions within 30° apart, and when tint, shade, or tone is similar in value in both colours. When the colours in question are far apart and broken, there will, as we saw, be an illusion of enhanced saturation; but when they are near, the illusion is one of displacement, the eye becoming hypersensitive to small differences.

Ex.: Place patches of yellow and yellow-green in contact, and the adjacent edge of the yellow appears orange-yellow, and that of the yellow-green appears distinctly green. But, if the patches be considerable in extent, their distant edges may be made to look identical by again provoking simultaneous contrasts with consecutive hues—orange against the yellow and green against the yellow-green.

Ex.: It was observed that saturated colour would flood white to a tint of its own hue. Simultaneous contrast between a neutral grey and a saturated colour, however, provokes in the grey a tendency towards the complementary of the saturated colour, while the saturated colour itself maintains its quality without the dulling from 'fatigue' which would be noticeable without the grey. The same patch of grey may thus be made to assume the quality of a buff, a sage, a slate, heliotrope, &c., by a juxtaposition with saturated colours complementary to these.

Ex.: A patch of broken tone violet may assume the quality of rose if placed upon a background of broken tone blue-green. On a broken tone of its complementary, a broken tone is rendered more saturated, as has been noted, but if on a broken tone from the right, or left, of its complementary, it will be driven to left or right, in simultaneous contrast.

CONTRAST is dependent on perception of difference, from the merely adequate to the extreme, and is characterized by reaction out of proportion to the actual difference in stimuli in moderate cases.

Colours, nearly adjoining in spectral hue, or only slightly distinguished in tint, shade, or tone, which suggest resemblance while separated by considerable areas of a complementary, will, in juxtaposition, reveal unexpected differences in hue, tint, shade, or tone.

Ex.: A high light on a dark object, though many shades, or degrees of perceptible difference, below the luminosity of the sky, will challenge comparison in virtue of the dark adjoining shadows. An inexpert painter would be liable to use a colour far lighter than the sky to represent this high light.

Ex.: In a tapestry it may be quite impossible to identify a golden buff used for the light side of a tree stem among dark foliage, with the selfsame buff used for the shaded side of a building in the middle distance, where the light side of the building may be a pink; yet the success of tapestry as a mural decoration depends very largely on the use of a set of colours very limited in range and in number.

Ex.: Contrast, without difference in hue, occurs where a tint is opposed to a shade. Primrose, a tint of yellow, is in strong contrast with olive, a shade of yellow. There is scope for abundant contrast within the ranges of tints, shades, and tones of any hue.

Ex.: The range of luminosity between a smooth black and a smooth white object, under a strong light, is often far less than the range between the luminosity of the white and of a short shadow cast upon the white. The blue shadow of a burnt tree on snow, for example, is darker than the charred wood on the illuminated side of the tree.

Ex.: It has already been observed that the ends of the spectrum offer extreme contrast in hue. Black and white, for any given illumination, represent the extremes of luminosity. With intense illumination all hues tend either towards yellow or violet, the division passing through the green and violet-red complementaries on the chromatic circle.

Successive Contrast phenomena correspond in a general way with those of simultaneous contrast except that in this case the juxtaposition is in time, not in space. A visual process usually called 'fatigue' plays a large part in such matters, the eye that has been fixed upon an area of saturated colour tending, on sudden removal, to convey the impression of a complementary, or negative, after-image. The cases where after-images are negative, or positive, or oscillating need not be elaborated, as design is concerned with more or less permanent arrangements of coloured objects.

Moreover, except in experiment, the eye does not fix and 'fatigue' itself on figures of uniform colour, but by constant movement renews the retinal apparatus of registration.

Recession in respect to the green-blue-violet group on the one hand, and Advance in the case of the yellow-orange-red group, may alternatively be described as a greater persistence on an increase of distance between the coloured object and the eye in cases where the latter group of colours are involved.

Ex.: In the case of a decorative mural portrait, necessarily appearing somewhat violent in colour at arm's length, but presenting notable verisimilitude at, say, thirty feet distant, it is very unlikely that the resemblance will be preserved at sixty feet, as some of the lower or neutralized tones in which blue is mixed will have at that distance disappeared, while reds and yellows will have intensified relatively. The modelling and complexion of the face will therefore change even if a plausible colour scheme results at all distances.

Constructed Colour arises from mixtures of unbalanced spectral elements; otherwise white light or neutral tones would result. The purples occur when the end colours are mixed, and lean to the reds, or the violets, according to the superior intensity (wave amplitude) of either of the ingredient-hued lights.

Ex.: Green and red lights on admixture provoke a colour sensation indistinguishable from a yellow of a luminosity only equal to their joint luminosities. Red and yellow lights on admixture act similarly in the matter of orange, but, orange being of lower luminosity than yellow, the constructed orange is more recognizable than the constructed yellow. Where the reflected lights from mixed pigments are involved, green and red fail to produce a yellow acting subtractively. A brown results, that is, a shade of yellow. The luminosity of spectral yellow is fully ten times that of spectral red or spectral green. Painting is largely dependent on skill in constructing intermediate colours from a few ingredients, adequate in saturation and luminosity, and yellow must be one of these.

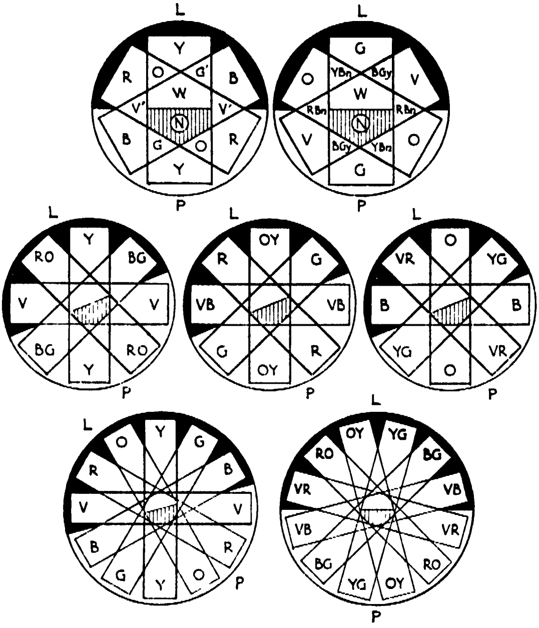

FIG. 7. Balanced groups of hues neutralize or cause whitish light, depending on whether mixed pigments or mixed lights are used. Any number of hues act thus if equidistant on the chromatic circle.

ADAPTATION of the eye to changed light is of considerable interest to the designers of buildings. A first impression is apt to be an important one, and the look of an interior, entered from a place under greater or lesser illumination, or under an illumination different in quality, may be quite unlike its appearance after one has been in it for twenty minutes.

The most important thing to be understood about adaptation is that by this faculty a new standard of white is established in reference to which all colours (or all the colours that the new light can reflect), will be evoked, in virtue of differences in wave-lengths, as distinct from actual wave-lengths. The colour sensations corresponding to the actual wave-lengths have become established in relation to noon sunlight, which is, after all, an arbitrary standard, though one justified by its generality.

The effect of coloured lights (mixed, pure, or deficient) on white, on their own hue, and on their complementaries has already been noted.

What happens on leaving the sunlight and entering a church deriving light through stained glass of a general amber tint, let us say, is that 'white' objects (objects that would be white in sunlight) first look amber-coloured, and objects of the complementary bluish violet, if present, are indistinguishable from those of a neutral grey, but by degrees the 'white' (first seen as amber) establishes itself as white, but any amber-coloured object becomes white also. So with a red-orange artificial light; when it is first turned on, the page before one (till then seen as white in a failing bluish light) shows orange-scarlet, but in a few minutes the page is white again. Meantime, the grey haze outside has become a rather vivid broken tone of violet sharply contrasting with the woodwork of the window, whatever its pigmentation, seen under the red-orange rays. Within the room, greens and reds, though both shifted towards violet, can be appreciated. Shadows really brown are taken as neutral.

Adaptation phenomena under a steadily increasing white light tend to make the colours shift as stated above towards a yellow and a violet, while apparently losing saturation, i.e. becoming paler and paler in tint in the process.

Under a lowering intensity of illumination the colours become shades and disappear in the order of their luminosity, the brightest surviving longest and some shifting taking place.

SCINTILLATION is a device for making a colour look and keep pure, that is to say for overcoming the 'fatigue' engendered by all saturated or fairly saturated colour stimuli. 'Making the colour sing' is a phrase which, though quite unscientific, still describes the intention. The mosaic artists of the early Christian period were masters of this device, often producing penetrating and persistent colour effects with very little material of the actual hue aimed at. Suppose that a tint of a hue about midway between blue and blue-green is required. If this is produced by means of a limited admixture of material of the hue named with material of the flanking hues broken into and spotted with it, the colour sensation will be much more persistent than if the 'stimulus' is made up neat; also, an illusion of relatively stronger saturation will be engendered. How far on each side of the hue intended one may go for ingredients depends on whether a tint, tone, or shade is being dealt with and on other circumstances such as the strength of light. In the case of a tone one may go all the way to the complementary for a small proportion of the ingredient spots, keeping chiefly to equal tones of nearby hues. When dealing with a shade, an equal admixture from all hues other than those of the predominant group centring on the hue aimed at is in order. In the case of a tint, or a highly saturated colour, one is restricted to an immediate group; and the wider this group the less of its flanking hues (as distinct from its main hue) can be employed. Distance from the beholder, strength of the light involved, and the size of the scintillation spots affect any given case. Exaggerated scintillation always defeats itself and is the sign manual of the incompetent, whether paint, mosaic, stained glass, or roof-slates are in question.

It may be worth while pointing out that when the whole field of vision is occupied by stimuli of an identical colour value under an even and adequate light, then, by adaptation, the whole field is presently seen as white. If the colour value be built up by scintillation, the time will be longer. But if this effective scintillation pattern be magnified till the field seems no longer homogeneous, then we have a *colour scheme*, of one kind or another. An arrangement or disposition in which the colours hold is a scheme; inversely, once we have scheme the colours hold.

2. *Conditions for Colour Appreciation*

Scheme is always economical of colour stimuli with reference to the resultant sensations of saturation in the hues involved. There is a moderate degree of illumination under which given colours appear most saturated (to northern eyes at least). An overcast day in winter in northern France, or southern Scotland, where the vivid reds of tile roofs, the violet-blues of distances seen through clear but humid air, and the lush greens of a moist and temperate climate are in evidence, is a revelation of saturated colour to eyes accustomed to the brilliantly lighted and consequently thinly coloured landscapes of sunnier climes. These only admit of powerful colour under unusual and transitory effects of sky, unless smoked glasses are used. It is but rarely, or for brief intervals, that the brilliant autumn foliage of the St. Lawrence valley approaches in saturated effect the actually much lower-toned landscape of Tweedside under a November sky. The first condition, then, for seeing the available colour (experiencing highly saturated hues) is a moderate light.

Another condition, which concerns us, is the time of exposure. The blues fade rapidly on contemplation. Designed objects are usually intended for the eye to dwell on.

A third condition for colour sensation is that the retinal area stimulated be adequate, in other words, that the coloured object be big enough and near enough.

A fourth is that there be more than one hue involved; with but one in the field of vision, we see only blacks, greys, and whites, according to the luminosities involved, whatever be the wave-length.

A fifth is that antagonistic colour flooding, which reduces the saturation experienced, should be avoided.

A sixth requirement may be described as the need of either that balance of the hues present (so that they neutralize), on which schemes of contrast are based, or else that predominance of a definite hue, which is the foundation of harmonies.

3. *Colour Preference*

The hedonic values of colour sensations may now be investigated. Some persons derive the keenest satisfactions and pleasures from effects of colour; they are also sensible to dissatisfactions which they figuratively describe as pain. Pain is not of course the antithesis of pleasure—notwithstanding what the Victorian hedonists had to say on the matter. Displeasure, discomfort, dissatisfaction are much safer terms to apply in this connexion. The man who experiences no colour satisfaction naturally enjoys immunity from these sufferings.

The question, 'Are there positive colour values?', we must reluctantly answer in the negative. When a man tells you this or that colour is 'pretty' or 'beautiful' he tells you something about himself, and a little about the object, but nothing about the colour.

The attempt has often been made to ascertain by inquiry from numbers of persons what are their colour preferences; and, after tabulating the results, to draw conclusions therefrom. This misleading exercise has superseded the assumptions of inquirers who, bemused by the Darwinian theory, supposed that an arboreal ancestry has left within us all a congenital delight in red and orange and other fruit-colours.

The German investigator who ascertained that the young men of Ontario were partial to a colour combination of 'orange and blue', but strangely had no favourite single colour, threw far more light on this matter than he either imagined, or deduced. Homogeneity in the results of other inquirers is also due to the restricted characteristics of their victims. Patagonians, Venetians, Oxonians, and hairy Ainus might be expected to give us variable tables of preference.

Inquiries among northern civilized people (chiefly male students) have been found fairly consistent, but this very consistency is due to their common experience of colour in association with certain things. Blue heads the list, and lemon yellow is at the bottom. The preference for blue is probably due to two accidents of Nature. It is the colour of high spectral saturation most widely distributed in everyday experience, and hence very readily distinguishable, analysable, and recognizable as to purity. It is also a colour associated with that creature comfort and well-being incident to fine weather. Other more artificial associational motives for this preference might be found in the dress of the navy and the sporting colours of certain universities. As to lemon yellow, it is a colour readily distinguishable, but its occurrence in the European landscape, due to the mustard weed, is unfortunately disturbing to the general balance of colour in a green land, under grey or blue skies, and the association with a citrous fruit that cannot be partaken of except as a diluted flavouring makes people say that the colour 'puts their teeth on edge'—their eye teeth, no doubt.

Then there is the colour magenta to be reckoned with, the occurrence of which, anywhere outside the range of full tropical sunlight, is deplorable. It is the bane of the gardener—the curse of the ballroom. Drenched with adequate sunshine, it may be placed in juxtaposition with scarlet and orange without offence. Saturated, it is becoming to the negress, but desolating to our women. Its tints, shades, and broken tones are invaluable in the contrivance of colour schemes. It has the accidental vice of occurring in Nature at a very high saturation, when at all; that is at a splendour of purity with which other colours cannot compete.

What this all amounts to is that people do not, and cannot, come to like one colour more than another, as colour, though they readily fall into the illusion that they do so. Familiarity and association account sufficiently for all colour preferences, cherished or expressed, but familiarity is probably the more potent spell. Colours have no absolute values independent of the objects sustaining them.

4. *Colour Influence*

Before coming to grips with the problem of colour satisfaction, another superstition must be dealt with—'the psychology of colour'; that is to say, the theory that specific hues or certain tints, shades and tones of certain hues correspond, or tend of themselves, to arouse certain emotional complexes, or frames of mind. There is here again nothing beyond association of ideas—the past experience of the person in question. As already noted, those who share a given culture and environment have a common fund of experience and will react more or less homogeneously to colours associated with things agreeable or disagreeable, especially in the matter of the weather. We have known a child of three to become wildly excited on seeing a sunset with its reflection dancing on rippled water, and shout, 'Colours! Colours!' It was a dramatic affair of orange and duck-egg blue with massed purples and a break of red fire near the horizon. Quantitatively, there was abundance of stimulus. The attention was attracted and held—a livening experience. The familiar sky, river, and forest were transfigured. That had much to do with the excitement.

Now, in the effects of Nature, certain colours and general colour schemes are inevitably associated in the minds of the observant with certain weather conditions, than which nothing is more potent to provoke mood. High and low barometers indicate weather conditions which produce in us, as in fish, fowl, and other animals, states of exhilaration or depression; and strange are the moods we experience on a change of weather of whatever sort. Then again, the daily cycle of refreshment, activity, and rest inevitably associates itself with sunrise, 'the labour and heat of the day', and sunset. A moon rising serene through a lavender haze, and a moon struggling fitfully to shed blue-green light through driving storm-clouds, are natural accompaniments of weather conditions under which a tired man may be soothed, or stressed to breaking-point. Dawn and sunrise induce emotional reactions very different from those of sunset, yet the colour schemes involved are often identical.

And so with the natural phenomena, the woods, the sea, the hills—all have their colour changes, but it is safe to say that for those who labour and for those who rest, and for those who sport in contact with these good things of life, the frames of mind evoked are very different. 'Heavenly weather' on a lake may be aggravating to a degree to the angler, and a thundering gale at sea be extremely gratifying to a mariner driving before it to his port.

Colours in themselves—and it has been made clear that colours are as the mind makes them and far from being accurate registrations of energy transmitted in specific wave-length and amplitude—are of little significance. Colour schemes, on the other hand, can by association revive moods rather than memories. Thus the artist, without resorting to the representation of natural phenomena in landscape, may in pattern or decorative scheme, or even in the assemblage of an environment, as in the furnishing of a room, produce with calculated intent something which to the average or special beholder, but not to all beholders, is restful or startling, depressing or gay, discreet or exuberant—always provided that the beholder and the artist have a good deal in common in the way of experience of life.

The man who paints his floor ochre, his walls French blue, his doors grey, and his ceiling pink, may indeed have expressed himself, if the genius of his ego is of a blistering vulgarity. He fails as a gentleman, in so far as he obtrudes his taste unmercifully upon his guests, and he fails as a craftsman because he could get far more blueness and pinkness, and yellowness and greyness by a more skilful and economic disposition of his media with reference to the limited illumination at his command indoors.

It will be generally agreed that the above specification is not a prescription for a thing that is agreeable, and it is a condition of aesthetic activity that the emotional complex, whatever its character, be conveyed in pleasurable sensory terms. *Where colour is involved this means by a scheme.*

Now consider red, the colour of fire, of blood, of Crimean heroes. It is supposed to be attractive to fish, annoying to bulls, disturbing to man, and in the shires the foxes are said to dislike it, for obvious reasons. This is also the colour of roses, of sealing-wax, and of a tape beloved of bureaucrats. Red, as red, connotes no specific mood. The stronger tints and very slightly broken tones of red are becoming to the complexion, provoking, especially under artificial light, an illusion of health due to the phenomenon of colour flooding. As to blue there is the old saw that it is 'the prettiest colour that's worn'—which is so in daylight, if you possess fair hair and blue eyes. It is not the colour, but the colour scheme, that does the trick, and makes hearts beat the faster; and not the colour scheme in itself, but with reference to the matter in hand. It is colour scheme that nature lavishes on highlands and islands for the delight of Sir David Y. Cameron and of ourselves very often through him; and it is colour scheme that the late Mr. Bodley devised for the glory of the Anglican Trinity at the Pendlebury Parish Church, and elsewhere. It is colour scheme that makes the parks gay with loitering humanity on summer afternoons, and its memory may leave Mme Pavlova dancing before the mind's eye long after 'the trembling string' and flittering feet have ceased to vibrate.

Colour scheme, deftly applied to occasion, is all enchantment, but a colour is ultimately interesting only in its relation to the scheme supporting it.

5. *Colour Schemes*

We pass now to an analysis of some of the more general and characteristic kinds of combination of colour. Though impotent of themselves, yet as ingredients of a work of art, or an experience in life, they can stir the heart of man.

A MONOCHROME in painting, decoration, structure, or dress, is a scheme confined, as the derivation of the word implies, to one hue, differentiation being limited to tints, shades, and tones, or to any two of these, and, in extreme cases, to one of these modifications of the parent hue.

Ex.: A sepia engraving on cream paper is a case in point. On bluish-green paper there would result tints of blue-green, neutral greys, and shades of orange or of red depending on the quality of the sepia—a contrast.

Ex.: Liverpool Cathedral, which is of red stone, constitutes a monochrome when seen in a diffused rosy light. Under a blue sky the shadows might be violet and the sunlit stone would tend to orange. Without the blue sky in the field of vision it would be a harmony; with the sky included, a contrast.

A TONALITY indicates the predominance or persistence of a hue throughout a scheme. This does not mean that the scheme is actually confined to tones of a given hue, but that all the colours involved, or suggested, are held together by a common hue element. More than half the chromatic circle may be implied but much less than half must be actually involved and the dominant hue is central of the group. (The word 'tonality' is unfortunate, deriving from a time when 'tone' was commonly used to mean 'hue'.) Orange is the most common basis of a tonality, and usual with the Venetian school.

Ex.: A landscape seen at sunset presents a colour scheme of this kind in which a definite hue is dominant and all others are relatively modified or annulled.

Suppose the case of a red sunset; a red brick gable catches the light—a sealing-wax red of high luminosity resulting; there is snow and it takes on a salmon tint which becomes the relative white; the shadows on the snow will be mauve or violet. Objects that would be blue-green in a white light will show, of course, as neutral grey.

Ex.: Many medieval stained-glass windows have acquired, through decomposition of the glasses of all hues, a magnificent quality of tonality they never possessed when new. The same is true of many 'old masters' under an age-stained yellow varnish. A cleaned Romney may appear shockingly crude to a person accustomed to see his work under old varnish.

Ex.: Scintillation has already been referred to, and may be regarded as a scheme with respect to the passage of colour in which it occurs—a scheme, of course, of limited range and with the character of a tonality.

HARMONIES are based on a group of hues (and their tints, shades, or tones) derived from a limited region of the spectral circle. It is usual to consider three evenly differentiated hues as a minimum number and half the spectrum as a maximum range. If more than half the spectrum is involved the scheme might be considered as an unbalanced contrast of two near groups rather than as one strong group. One-third of the spectrum is usually enough if it is desired to preserve the 'form' of a harmony. A harmony may, with advantage, be strongly balanced on its central hue, either due to its superior saturation or the amount of area in the composition which it claims. A harmony (in pigmentation) designed for white light is seriously disturbed by a mixed light, and is destroyed by a light of homogeneous hue. It will be remembered that the addition of red light to white light will make a red object seem redder, while the substitution of pure red for white light will make a red object appear as white and distort all other colours. Most harmonies are really made up of tints, tones, and shades of the group of hues involved.

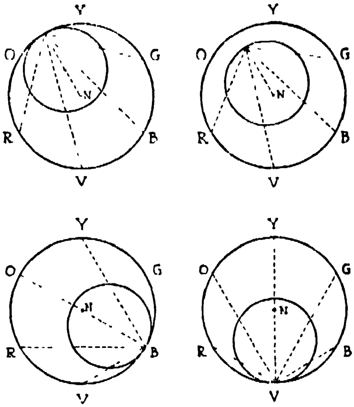

FIG. 8. The outer circles represent the 'colour wheel'; the inner circles represent the modification of colours used in harmonies based on the hue at point of contact. The hues on the edge of the large circle here neutralize gradually to N. at the centre. Thus, with a full blue, one uses a heavily neutralized tone of orange, and, for red, yellow, violet, and green, adjusted tones of these hues.

(After Professor Arthur Pope's diagram)

Ex.: Harmony is inevitably produced in moonlight because the blue-green light sets a very definite limit to the colour sensations that can be set up by reflected light, no matter what the daylight effects of the objects seen might be.

Ex.: Under white light from which colours of every hue may arise, harmony is dependent on the presence of coloured objects, or pigmented areas, restricted as above explained. A confined view in the autumn woods, under a grey sky, would be a case in point ranging, let us say, from red to yellow-green.

Ex.: A room in cream, old gold, buff, and olive would be a harmony of about the same range as the above described autumn wood.

COLOUR CONTRAST has already been considered as a phenomenon; it is now considered as a scheme classification. As noted, it is greatest as to colour when the extreme ends of the solar spectrum are involved. A contrast may be very simply based on two widely separated hues of equal or unequal saturation, or again, it may consist of two widely separated harmonic groups. The type of contrast of most frequent occurrence in Nature consists of a harmonic group of fairly wide range set against a single complementary, or against a restricted complementary group.

Ex.: If, in the case of the autumnal woodland scene above referred to under harmonies, a bit of blue distance or a peep of blue sky be involved, we have a scheme of contrast, and the reds, browns, and yellows will be set up in saturation if the blues be moderate.

Ex.: In painting, decoration, or furnishing it is far easier and more effective to increase the sensation of a saturated colour by the introduction of a spot of a complementary than by raising the saturation of the main colour group involved. Warm blues occurring here and there in the covering of a chair, or in a curtain, will give a golden glow to a putty-coloured wall-paper.

BLACK AND WHITE CONTRAST. Blacks, whites, and greys may be introduced into any scheme of colour contrast without affecting it. Contrast within the black and white elements is, likewise, a possible basis for a scheme, and the black and white, or dark and light grey, contrast may be subordinate to the colour contrast or vice versa. By the use of tints and shades the two systems of contrast may be inextricably interwoven.

MIXED SCHEMES. Any landscape, or street scene, or interior under daylight conditions will tend to be a mixed contrast, involving both colour and light and shade. Even if all hues are involved, some by their predominance in area, or in saturation, will tend to set up a scheme. This they do, if strong enough, by flooding collateral hues while neutralizing complementary ones; or, if moderate, by enhancing the hue character of complementaries; or again, if moderate, by increasing the hue difference in adjoining areas of collateral colour. Thus there is always a *scheme* in nature.

BALANCE. It is difficult to make out any case for the virtue of balance in the sense that all the colour present, if mixed together, should give neutrality. Balancing on the centre, or axis, of the composition is quite another matter, as when a small area of highly saturated colour balances a large one of the same hue in tint, tone, or shade. The virtue of such arrangements is in maintaining the scheme throughout the composition. Otherwise the mere presence of strong colour to right, or left, or even high, or low, in the field of vision, or picture, is apt to set up a separate scheme in its own immediate neighbourhood.

6. *Hedonic Effect of Colour*

The one analogy of service between aural and optic sensations is this, that neither through the ear nor through the eye do we derive any direct knowledge of the processes at work in these organs, nor of the vibrations that stimulate them. The sensations of colour, and of sound, are in themselves purely subjective affairs. The fact that indistinguishable sensations can be produced by a spectral hue and a constructed colour is significant. Enough has been said above to show the very relative nature of all colour sensation and how, under a given light, the mind constructs an equivalent white sensation and a relative more or less complete set of hues based on experience under solar light. Nature rarely gives us a pure white light, but furnishes tints and tones of coloured light, pure-hued light only occurring artificially. It is very seldom, either indoors or out, that we can experience a truly balanced gamut of all hues; either some are dulled, or some are invisible. The eye may therefore be expected to have developed as an instrument which functions best under the usual conditions, when only about three-quarters of the spectrum is operative. With a tint of coloured light, all colours are distinguishable, but those of the tint group are enhanced, and those of the complementary group are more or less neutralized. With a tone of coloured light some colours are far more responsive than others.

Then, again, the colours of the spectrum vary in luminosity, and, in consequence, with a low increasing illumination some (orange, &c.) precede others in becoming distinguishable. Groups of colours of deep shade are not then easily interpreted when they belong to hues of the higher luminosity series, such as the browns.

With increase of illumination colour reflected from objects not only changes its spectral character of hue, but becomes less and less perceptible, the yellows and violets being the most persistent. Thus, objects whose colours may be in hopeless discord under a moderate light, may acquire harmonious colours on reduction or increase of illumination; that is to say, the inharmonious colours no longer exist, and are replaced by others which are harmonious.

In this category of the commoner phenomena of colour vision, no attempt has been made to expound, for each case cited, the physical, physiological, and psychological hypothesis that accounts for what is observed. Many of these phenomena are not yet accounted for satisfactorily. The intention has been, however, to keep before the mind of a reader, unfamiliar with these sciences, a general consciousness of the bearing these phenomena have on problems of colour design, and to dispel that temptation to wander down the easy paths of mystic fantasy which too often besets those who explore the boundaries between the hedonic and the aesthetic.

One simple and helpful fact emerges—the eye and all the mechanism behind it has been evolved to see in daylight, and the mind learns, through its daylight experiences, to differentiate a limited series of quantitative sensations.

These experiences have a common characteristic: the organ concerned can only derive from the images of objects sensations of such colours as are ingredients of the light falling on them. Congruity and verisimilitude in this respect is a touchstone of satisfaction and conviction in artificial colour combination. The artificial colour scheme that seems to violate this principle leaves the mind guessing, wondering, and abhorrent.

The illusion of colour preference has been exposed, but the efficacy of colour schemes in provoking mood has been admitted. This does not mean that there can be a general system of symbolism, or expression, relating schemes to moods. Where the artist and his public happen to enjoy a common experience of weather and landscape and the apparatus of life, he can make use of certain schemes involving certain colours with a reasonable hope of making others feel as he has felt. Colour, however cunningly manipulated, is not a universal code.

There is, however, a general appetite for hues of considerable saturation—an optical appetite, if you will. This appetite cannot be satisfied in very strong light. Over-stimulation is incompatible with functional efficiency in this matter as in others.

Moreover, the illusion of considerable saturation provoked by contrast, appears to be far more satisfying (because less 'fatiguing' and therefore more persistent) than actual saturation. Our delight is in easily perceived difference, rather than in a sense of the quality. Colour flooding is destructive of the renewal of stimulation; it is the symptom of excess. Mutual colour flooding, where two or more fully saturated hues are involved, is parallel in effect to a gorge of rhubarb and clotted cream—an optical indigestion or discord.

Such are the meagre functional satisfactions that 'gladden the eye' in the matter of colour, notwithstanding the fact that colour dissociated from an object reflecting or transmitting light is neither thinkable, rememberable, nor enjoyable.

Colour from light and colour from objects must be clearly distinguished by the designer. It is open to the artist in any given case to use colour in either or both of these manifestations. He is unlikely to achieve a calculated effect unless he understands the difference between a white thing that looks red because some light bereft of orange, yellow, green, blue, and violet constituents is playing on it, and a thing that looks red because white light is playing on it, while it is absorbing all the constituents but red. He should further be able to appreciate a grisaille clerestory window, in a red-stone church, pouring light upon an altar frontal of green damask silk, as well in imagination as when facing the fact.

Colour memory, always attaching to things, and depending as it does on past experience, is not normally homogeneously developed for the whole chromatic circle. This accounts for characteristics in the arts of races and of the masters. Most painters of northern landscape can realize in hues a score of greens, a dozen of yellows and reds, half that number of blues, and about two purples. A hundred colours, based on a score of hues, represents a good equipment for an amateur. For the general public six hues and a score of derived colours is all one should expect. It is usually among decorative artists and furnishers that the best balanced colour imagination is to be met with.

Now the enjoyment of colour is very largely an affair of recognition and for that colour memory—which implies colour imagination—is the great prerequisite. Colour faculty is often a native gift, but it is extraordinary how far it can be developed by exercise; also how much it can be perverted by unsound doctrine.

And now, in conclusion, let us face the fact of colour interest transcending object interest. There is inevitably the connexion with an object. The blue that may be a delight in a scarf, to the point where the scarf is regarded, owned, worn, or painted, for the sake of the blue, would really be abominable in a roof. Passing along the street one may be attracted by colour, saturated or otherwise—the colour of a cloud, or a spire, or a tree, or a flower, or a dress, or a cheek—and one falls very readily into the illusion that it is the colour itself that gives delight when in reality it is a thing of the kind in question of that colour. This delight is nine-tenths association and the rest expectation and discrimination in about equal parts. Thus one may enjoy the flesh-colour of gladioli and the blue of delphinium chinensis in our neighbour's garden, just so long as the inconsiderate wretch does not turn these things into mud by allowing some spot of desperately saturated magenta phlox to 'hit us in the eye'. Yet, if this same resolute stuff be in sufficient abundance to control the whole situation, sky, trees, houses, river, and all, it is as fine a sight as the 'eye' can 'feast' upon.

A developed sense implies some delicacy of mental organization; the understanding of colour phenomena (which may, or may not, be of assistance in developing the colour sense, depending on the mental make-up of the individual concerned) involves both intelligence and perseverance. As a vehicle of aesthetic activity colour is potent precisely in the degree in which it can be manipulated to elucidate form. Aptly used with that intention there are few moods that it may not on occasion serve to communicate or to enhance.

7. *Epitome*

We are now ready further to elaborate an example cited above. When holding my book near a window to the north in a failing, greying light, with a muddy shadow from my hand sprawling across the lower margins, I mended matters by switching on an electric light hard by. At once the page flushed red, and as this faded towards a new whiteness the shadow became a miracle of colour. From the thumb a yellow and a violet shadow now crossed each other in pearly greys, emerging brightly distinctive on either side, while beneath my little finger a spot of clear rose blurred in the violet of a shadow edged with buff. To call all this beautiful is perhaps to mistake the hedonic for the aesthetic in announcing a satisfaction honestly independent of its causes. Now the moment I investigate the causes this thing becomes vastly interesting, but no longer exquisite (a proper word this to apply to fine sensations). The appearance of the dot of rose hue beneath my finger was due to the double light being strong enough to penetrate the tissues and, there losing its colder elements, emerge as feeble red light to mix with the violet shadow. The white of the paper was made up of the violet and blue of a fading north light, mixed with the relatively red and yellow tinted light of the electric lamp. Where either of these lights showed exclusively on the paper, a shadow of that light appeared, and where both were excluded, a neutral shadow. It was because I am capable of making a fair representation of such a phenomenon projected on paper with water colours, and would thoroughly have enjoyed attempting that task, that the word 'beautiful' slipped out.

Scientific understanding of colour is necessary for the artist as technician, but woe betide him if his work arouses scientific interest in the beholder. It is by direct assault on the senses (in the case of colour a rather indirect and vastly complex sense better describable as a mode of knowledge) that the artist provokes response and revival of feelings with respect to the realm of things. In doing so colour is a very ready instrument to his hand.

VI

THE NATURE OF FORM VISION

1. *Introductory Explanation*

WITH regard to colour much still remains to be done before physical phenomena, peripheral reactions, and cerebral processes—light, eye, and mind—can be justly allotted their several roles. An attempt has been made to sort out the hedonic elements that may accompany our realization that colour is before our eyes. This has been done simply and solely because in the arts of DESIGN such hedonic elements—pleasures, satisfactions, delights—are the means to our ends.

In approaching the problems of satisfaction in form vision, as distinct from colour vision, the inquirer finds himself less well equipped with scientific data and perhaps less handicapped with scientific controversy. Little has hitherto been attempted in the way of explanation of our interest in forms, while what has been done in the way of investigation of the seeing of things, with respect to their size, shape, and position, is all but limited to a reconstruction of the mechanism of the eye and an enumeration of its mechanical defects. Any one who approaches the problem immediately before us need thus have only a moderate fear of stating opinions already disproved. He requires, however, something of the courage of those who wander in untrodden forests, where many interesting things, such as rivers, and lakes, and rocks, and marshes, and mountains await him, the physiographical relations of which he may easily mistake.

In order to make the distinction between colour vision and form vision clear, before proceeding to discuss the satisfactions derivable in connexion with the latter, a descriptive summary of what is known as to how form is seen may be of use. This will be followed by a review of some of the commoner optical illusions whose significance with respect to form vision is somewhat analogous to that of colour blindness in respect to colour vision, with this difference, that colour blindness is an abnormality, while many optical illusions are normal. In the succeeding chapter a classification of form will be made, followed by an attempt to analyse the hedonic reactions which may accompany perception of natural and artificial forms falling within these categories. The basis of judgement, of preference, and of critical appreciation with respect to the shapes of things, will then claim attention; this will involve the problems of type and character.

To many the doctrine that form inevitably means something—that its appreciation is an affair of the understanding—must appear unpalatable. They may ask: In art, at any rate, when form conveys mood, does it not do so by virtue of inherent abstract character? Our answer must be: No, it only seems to do so. In all such cases there is a background of association with a form that is real and understandable. Significance is founded in the practical.

The conclusions at which we arrive will have a direct bearing on matters discussed in later chapters which treat of form as used in art. The part of the present chapter which touches on optical illusions serves as a direct prelude to the practical discussion of corrections and refinements later on; while the subsequent discussion of proportion will be based on the review of organic and abstract form in this section.

To some, such an approach to 400 pages of precepts respecting design in general, and architecture in particular, will make no appeal. For such it is easy to gate the alleys of inquiry by rhetorically acclaiming unity the means and the end. And this gate can be made graceful withal—so graceful that the hinges and the lock are often omitted as disfigurements. That some of the alleys besetting the path are blind must be frankly admitted; but a few seem to lead in the right direction.

Meantime, in our present state of knowledge (and ignorance) it is appropriate to make a summary of results obtained till now, so that a student of design may satisfy himself how far he may go on firm ground and when he must be prepared to take the risks of flight, with the chance of drowning in troubled waters, or perishing on the mountains.

We seek to establish the limits, wide or narrow, within which hedonic reaction may be stimulated, if at all, by abstract form, and to accomplish the easier task of finding under what conditions the sight of things may generate many kinds of gladness. And if precept for artistic technique is indeed, as some aver, wholly incapable of ensuring delight and the lesser moods of happy living, at least it may be expected to do something for the exclusion of the incongruous from the apparatus of life.

2. *Seeing Things*

The physical data respecting form vision are far simpler than those connected with colour vision, but the physiological and psychical data, besides being less adequately explained, give indications of an infinitely greater complexity. Where science has failed to provide a mount that will carry one over these difficult hedges, one must be content with the notoriously illusory evidence of the senses on which to charge a way in, and possibly through.

It was seen in the review of the problem of colour that such words as harmony and contrast were applicable to colour as well as to sound, although the stimuli concerned are of radically different orders. It is important to realize that it is the character of the reactions, and not the nature of the stimuli, that is akin. In dealing with form we find that phenomena of simultaneous contrast, of successive contrast, of discord, and of scheme all occur, but their causes have no analogy whatever with the causes of parallel phenomena in the realm of colour experience, even though form itself is only apprehended through diversity of colour value, understood in a wide sense as embracing also white, black, and grey—light and shade.

It is not necessary to repeat in detail what has already been stated as to the character of the organ of sight as an optical instrument capable of direction, accommodation of focus, registration of image, and renewal of 'plate'. Examples have already been cited to illustrate the process by which stimulus, always synthetized with experience, is projected into space as knowledge of things as they are or seem to be to others also. These accounts of visual process apply here, but it will be necessary to enumerate several additional peculiarities of the optic organ which aid in the perception of the relative positions of things seen and some which tend to the registration of erroneous impressions.

When, in the course of this chapter, the eye is spoken of as distinct from the mind, the whole apparatus of binocular vision, working as one instrument, is to be understood. That the eyes can be used separately and yet simultaneously can readily be discovered by looking at the familiar hieroglyph of three stars as they are wont to occur on bottles of warrantable brandy, or on the arms of George Washington. Without recourse to the contents of the bottle, in the one case, or letting oneself be blinded by hero worship in the other, the three stars can be so looked at that one sees only two, the proved and ascertained three, four, five, or six. One cannot see less than two, or more than six.

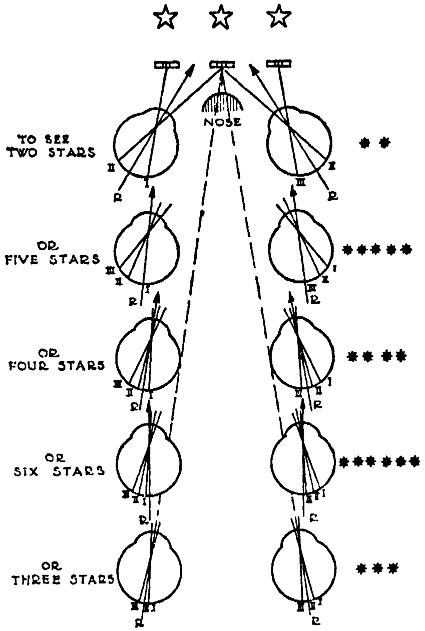

FIG. 9. This diagram shows how images on corresponding and non-corresponding points of the retina provoke cerebral impressions, in which each eye separately and both acting together may be concerned at the same moment.

But without recourse to ocular gymnastics of this kind, look at a near object, such as a vertical window-bar, with a further object, such as a street lamp, on the other side of the window, and then look at the far lamp with the bar intervening. Do both things, first with each eye, and then with both eyes. You find that nearer and farther things, seen but not looked at, provoke in the organ of vision several images from which selection is made, under the guidance of experience, memory, association, and the acquired habit of usually giving credit to one eye at a time. Even the views the two eyes get of a nearby object, such as the inkpot at one's elbow, differ, and if one analyse the contour of the inkpot, one cannot at the same time analyse the contours of the portions of objects just beyond it, which it partly hides. When one observes with concentration an inkpot and a strip of postage stamps behind it, as if these objects constituted a group, or *one thing*, using both eyes to do so, then the stamps and bits of stamps appearing on the right side are what the right eye sees, and those on the left are what the left eye sees. That is to say, the mind normally selects from among the images presented in the organ, in accordance with certain ascertainable principles. Linear perspective furnishes an approximation of a simple geometrical kind to a possible field of vision under given limited conditions, and is roughly correct within a 60° arc; but the very conventions of perspective greatly affect the way people, familiar with drawings, interpret what is actually before their eyes.

3. *Retinal Images*

Perception of what is within the field of vision as an agglomeration of variously coloured figures intercepted on a plane perpendicular to the 'regard' (or line of direction of the eyes) has often been described as the way the infant sees, till it learns by experiment and experience to associate appearances with depth and position in space. The history of drawing and the common experience of those who have both learned to draw, and taught drawing, lend some support to the view that the interception of what is seen, as on the plane above referred to, on the part of adolescents, is a faculty requiring much will power for its development: also a good experience of things represented as thus intercepted in drawings or pictures, and last, but not least, a rigorous subordination to convention.

Let us understand clearly that retinal images, though of immense importance in enabling us to estimate the relative position of objects in space, are not by any means complete little photographs of what is outside of us in the direction we are looking, nor does the mind ever become sensible of what is taking place on a healthy retina, but only of the outer things causing *retinal changes*. In the field of vision there is only clear definition as to images falling within a few degrees by angular measure of the centre of the retina, and there is continual variation of focus on what falls within these degrees. Moreover, the eye normally jerks and jolts the regard with about a dozen movements per second, whether one is looking at a ship on the horizon, reading a line of print, or contemplating the regularly curved profile of a Greek vase. Indeed, it is on this restlessness that the renewal of the 'plate' in this natural camera depends. It is thus clear that the relatively constant knowledge we have of our immediate surroundings is a mental synthesis based for the most part on experience, largely the experience of other senses, and stimulated by a rapid succession of extremely complex visual sensations, or local signs, of which we are happily quite unaware. Sight is knowledge of certain qualities of external objects. It is partially derived from retinal images, it is readily stimulated by retinal images, but once established in memory it may be independent of them.

Whether the sense of shape in two dimensions is an elementary resultant of visual activity, or one laboriously acquired, it serves as a basis for the consideration of our interest in regular figures. It is commonly supposed that there is a magical and inexplicable charm for the optic organ in regular figures. All such regularity is, from its nature, an expression of numerical or mathematical relations, and this has apparently misled generations of designers into supposing that, by the use of such figures, they can provoke ocular sensations of form which are agreeable in much the same way that notes, as distinguished from noises, are agreeable. It may be observed that the regular figure has its mathematics sticking out all over it, so to speak, while the note conveys within itself no explanation.

The analogy between colour sensation and sound sensation was seen to be slighter than cobweb. Where form is concerned there can be no analogy with sound at all. The sense in which form may be the potent cause of hedonic reaction must be regarded as all but entirely an affair of the mind. Sensation, even of that very indirect kind furnished through the eye, has very little to do with it.

4. *Perception of Space*

The current view on the perception of depth may be summarized as follows: Where the book in the hand, or the instruments on the drawing table are concerned, each eye has its own version, and the mind projects externally the image of an object capable of producing these versions at a distance ascertainable by reach. Once the object is familiar, its distance is readily inferred without movement from the images required to make it up. Experience is thus a large ingredient in the placing of near things. Beyond that convenient range that the baseballer pitches, or the cricketer bowls, distance or depth is an affair of inference from relative light, shade, colour value, and sharpness of outline, based on experience under normal illumination and atmospheric conditions. But for work at hand, and up to what an angler would call 'within casting distance', we probably depend chiefly on retinal sensation to reveal environment, which we translate into knowledge of where things are, as an aid to knowing what they are.

The perception of size in respect to the perception of depth has a bearing on our problem. As scale is an element of architectural technique, to be dealt with later, and inasmuch as we are here considering the visual data behind the technique of design, a digression on the perception of size is necessary.

The sizes of retinal images and the circular measure of the beams of modified light which are their immediate cause are matters of which there is no consciousness in the process of seeing. There are many analogies between the eye and the camera, but none between the eye and the theodolite, or transit, beyond the capacity for vertical and horizontal revolution. The eye does not record circular measure. Size is interpreted in terms of space occupied relatively to known objects. The untrained have very little idea of the sizes of things they see in terms of standard measures, vaguely comparing things with each other; while the trained may attain an uncanny skill in judging rific ranges, or the sizes of ships afar off. In the perception of size and distance the overlap of intervening objects, atmospheric effects on the colour of lights and shades and on the sharpness of outline, the acuity of vision of the observer, and a hundred considerations of experience, as to the minor detail of the objects beheld, all play their parts.

Where there is satisfaction in seeing a big ship, or a little pony, such hedonic reaction may indeed have its seat in sensations, but they are not the sensations of the eye or of the moment.

5. *Contrast*

The visual process is continually concerned with comparisons of the colours, distances away, distances apart, and of the sizes of objects. When such considerations are applied to the parts of objects—i.e. to groups of visual elements seen as units—appreciation of form is instituted. A sphere and an icosahedron are thus distinguishable by the characteristics of their parts, and a tetrahedron, which is distinguished from both, is adjudged to differ from the sphere more than the icosahedron does. It is by recognition of the character of outlines, made up of straight and curved lines intersecting at various angles, that differences of form become apparent. Contrast in the form of objects (as distinct from contrast of all visual characteristics of objects) thus resolves itself into comparison of demarcation lines with respect to relative length, position, direction, and curvature.

Line, in relation to form, has two aspects, both of which may be the basis of contrast judgements: (1) *The actual lines in their simplest relation*, as, for instance, the boundaries of a tall window opening, which may be contrasted with the boundaries of a short window opening; and (2) *The seen lines*, as in the perspective view of the windows just described. The bulk of humanity interests itself only in what we may call the actual lines when deriving judgements, respecting differences of form, from the seen lines. That is to say, figures are habitually interpreted in their simplest form; as children, savages, and primitive draughtsmen represent them—in elevation for preference.

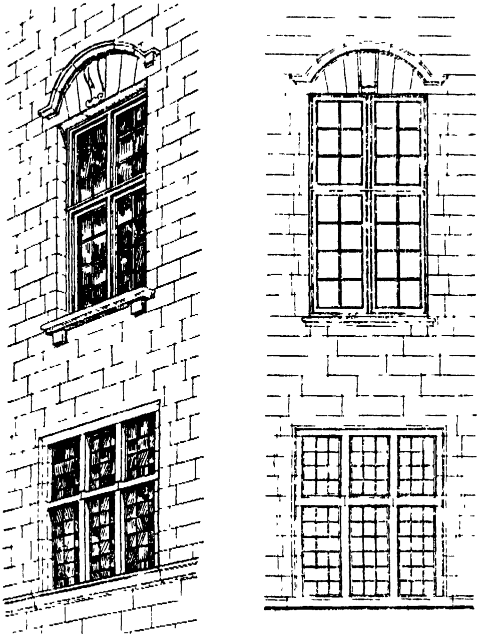

FIG. 10. Two windows as apprehended by the eye, on the left; and the same two windows as apt to be reconstructed in consciousness, in simplest interpretation, on the right.

As in colour, so in form, strong dissimilarities may provoke attention, but hardly an illusion of greater difference than is actually there. The lone tree on a hill-top and the embroidered gate of Salamanca compel attention, the one by contrast with the bare hill, the other by contrast with the plain wall.

Moderate diversity of form or size, on the other hand, like nearby colours placed together, arouses an exaggerated sense of whatever differences of character are present. It is only necessary to place a Clydesdale, an Arab, and a Shetland pony in the ring together, or to draw a Doric, Ionic, and Corinthian column on the same sheet of paper, to realize this point.

Harmony of form may involve the several parts of one form—a unity; or again it may be a relation of several forms bringing them into the looser unity of a group. In a later chapter there will be something to say on sheer consistency of design in the interest of unity. At this point it may be enough to observe that form is synthetic expression of purpose, material, and technique and, of its very nature, logical. Forms thus illustrative of cognate purposes or materials, and which enter the field of vision simultaneously, or in close consecutive order, provoke a cumulative impression.

Discord in form is involved in cases where the field of vision is invaded by objects of conflicting interest innocent of any common characteristics of purpose, material, and technique. The dome of the cathedral in Florence and the adjoining belfry—Giotto's Tower—would undoubtedly be discordant were not the minor elaboration of their forms mutually consistent. As it is, they have an element of unity in their detail that groups them together to enhance each other's diversities of figure and bulk.

The viaduct of the north side of the Quebec Bridge passes almost over an ancient village church which has much old-world charm about it. Each object has its own very abundant interest and character, but there is nothing in common. Their characteristics are not enhanced, but marred, by the confusion of an accidental juxtaposition in space. Things so diverse in character are better viewed apart.

It is not necessary to master the controversial intricacies of philosophic and psychological theory to understand what is meant by processes below the threshold of consciousness where form vision is involved. As instances, a photograph of an ornament in incised relief, or an aerial view of a section of country, will be interpreted in reverse in one position, and with vivid and correct reality in another. These flat representations will always 'read' in correct relief when the source of light illuminating the photograph corresponds in direction with the source of light that illuminated the object photographed. Moreover, if there is no marked source to light the photograph, the correct effect will be perceived when the photograph is so placed that the source of light that illuminated the object, when photographed, corresponds with the usual direction of the light one reads, writes, or looks at pictures by—front left. In looking at the illustration one sees either the ornament in relief, or one sees a mould for such an ornament, by an instantaneous, subconscious deduction whose premisses are in past experience of the effects of light and shade in relation to sources of light.

FIG. 11. The photographs are identical. On reversing the position this will be realized.

6. *Optical Illusions*

On passing now to the consideration of optical illusions it is to be remarked that there has been much controversy as to their explanation. Generally it may be stated that they originate in the optic rather than the cerebral process, or rather at the optic end of the joint processes, and so come as near to being sensations as visual experiences of form can be. The earlier tendency was to seek explanation in terms of muscular movements directing the eye. Latterly, with the recognition of the fact that the movements of the eye are invariably jerky, the eccentricities of the surface of the retina, on which the rays from straight lines and rectilineal figures must fall, has been taken into consideration. Each of the commoner illusions is known by the name of the distinguished scientist who first offered an explanation, but as many of the earlier explanations are demonstrably erroneous, the illusions will be referred to simply by numbers, a method which tends to keep the controversies at a distance.

The object in touching on this as yet very imperfectly understood group of phenomena is the investigation of such 'pleasure-pain' elements as may on occasion be associated with seeing regular forms as they are not, or the contemplation of nearly regular forms modified to produce an appearance of regularity. An intuitive visual interest, of a mathematical kind, in regular figures has been mentioned and it has been shown that the regularity of the image or pattern on the retina has nothing to do with any satisfaction that might be involved.

The illusions cited represent only a few of those most commonly of interest in architecture, and involving groups of lines and the boundaries of figures. Before reviewing these illusions, a remark on seeing and judging a square may be helpful. In order to facilitate such a judgement, one places the square in a plane at right angles to the regard and at a distance where it can be seen as a whole, that is to say, where its reflection on the retina will occupy a small area in the centre. Then one looks at the sides in succession, and at the angles and appraises directly; or, if in doubt, one may turn the square around, and if one finds a certain lack of squareness to persist with each successive side up, one is satisfied that it is square.

Now, for certain derangements of the eye, which do not militate against interpreting squares as such, one may be fitted with spectacles which give the desired relief, but also a deranged sense of near distances, horizontal planes, and the like. With such glasses the square which one knows by measurement to be square may look distorted. With constant practice, using the glasses, the new retinal figure which really gives the distorted impression comes to be taken as the local sign of a square, that is to say, is seen as a square is seen by those of normal vision; but by the time this is accomplished, a square seen without the glasses will take a new distortion. Now all this time the actual retinal image is the development on a surface, more or less spherical, of the boundaries of a beam more or less square. Accuracy of judgement and appreciation of regularity in plain figures and regular solids is thus seen to be dependent in very large measure on both experience and intelligence, that is, mental interpretation. The normal visual apparatus, by the way, records a square as slightly broader than high and the top half as slightly taller than the bottom half.

ILLUSION NO. 1. It is generally accepted that when a vertical line and a horizontal line of equal length are seen together, the vertical one tends to look longer than the horizontal. When the lines are shown in the form of an inverted T, there is further exaggeration of the illusion as the result of the horizontal line being divided in two parts, each of which provokes comparison with the upright line. The upper half of a vertical line looks longer than the lower half. In most founts 8s and Ss are designed tapered and the extent of this taper appears greatly exaggerated by placing 8s or Ss upside down.

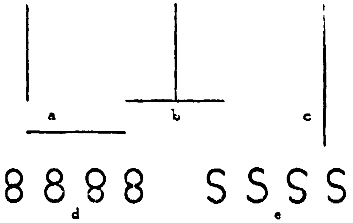

FIG. 12

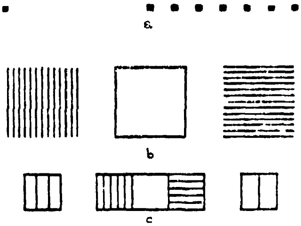

FIG. 13

FIG. 12. The illusion of increased size in the upper part of the figures. (The outer 8s and Ss are the same above and below their centres. The second 8 and S are reduced enough in the upper half to look so reduced; the third 8 and S are reverses of the second.)

FIG. 13. Illusions of subdivided space.

ILLUSION NO. 2. In the illusion of subdivided space we find that the outermost of five dots, say $\frac{1}{4}$ in. centre to centre, seems to be much farther apart than two dots 1 in. centre to centre, and that a square block of vertical lines looks broader than it is, while a square block of horizontal lines similarly spaced looks taller than it is. Thus, by taking thought, many cubits of apparent height or apparent length may be taken from, or added to, a building.

ILLUSION NO. 3. Contrast (which is the ultimate basis of technique in all arts) is as effective a principle to employ where form vision is involved as in the case of colour vision. The conditions for contrast in form are that the related lengths, angles, curvatures, areas, or

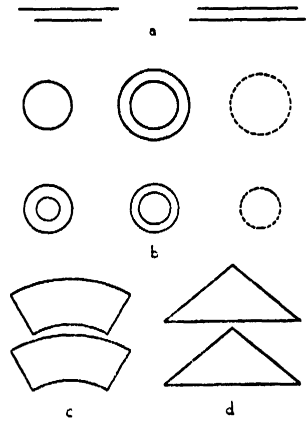

FIG. 14

a. The central lines in these groups are all the same length.

b. A ring shown by two concentric circles is 'read' as of the size of the circle midway between the contours. Thus a thick ring appears smaller than a thin one of the same size outside.

c. These two figures are identical, but do not appear so, owing to the enhancement of contrast in curvature in sides that are placed near together.

d. These figures are identical and appear so.

masses should occupy the field of vision *at the same time*, and that the differences should be moderate enough to maintain an element of resemblance. Two precisely similar lines (or circles) related to larger and to smaller lines (or circles) will suffer by simultaneous contrast an apparent change of dimension when compared. Similar figures, whose non-corresponding boundaries can by juxtaposition provoke simple contrast with respect to such boundaries, tend to lose the quality of similarity.

ILLUSION NO. 4. Closely allied to illusions of simple contrast and simultaneous contrast are those in which the more interesting elements of the figures involved tend to be seen as groups, with centres of interest for the groups. Thus, lines of equal lengths, with their ends elaborated inwards, or outwards, are judged as extending between the centres of interest of the elaborations. The principle here involved is called 'confluence'.

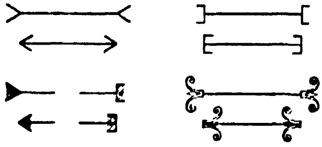

FIG. 15. These eight lines in pairs are all of equal length, but their lengths are interpreted as extending from the centres of interest of their elaborated ends.

ILLUSION NO. 5. The retinal image encourages an over-estimate of angles below 60°, and this tendency is most marked for small angles. Thus, the continuity of a line cutting two parallel lines is not at once apparent, and both the straightness and the parallelism of such lines is compromised. Parallelism and straightness may be distorted in various ways by series of oblique parallel lines meeting the main lines involved.

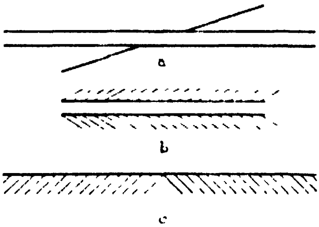

FIG. 16

a. The line interrupted by the parallel lines is straight.

b. The two thick lines are parallel.

c. The thick line is straight.

ILLUSION NO. 6. The effects of 'pencils' or groups of radiating lines, on straight and parallel lines intersecting them, is a further application of the tendency to over-estimate acute angles. The more acute the angle the greater the over-estimate; it follows that straight lines take on the appearance of curves when they encounter a series of lines at diminishing, or increasing, angles.

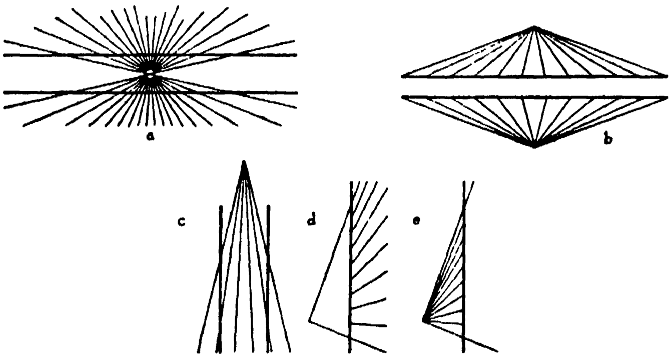

FIG. 17. In *a*, *b*, and *c* the thick lines are parallel. In *d* and *e* the thick line is straight and vertical.

ILLUSION NO. 7. The illusion of perspective, or depth, can be provoked in a flat surface by the judicious arrangement of radiating or even parallel groups of oblique lines. With the regard directed to the O (Fig. 18), so that the upper indented line takes prominence, one sees in the adjoining figure the representation of an overhanging corbelled wall, while with interest concentrated at the *, one sees the view of a staircase.

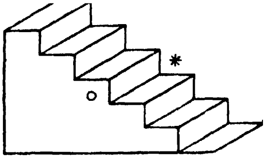

FIG. 18. This figure will read differently depending on whether a white wafer is put over the star or the circle.

Part of a pencil of lines, so set within a parallelogram that it might represent boards or courses of masonry, with sky or ceiling above and floor or ground below, at once suggests depth. Vertical lines of equal length if placed on such a figure running counter to the scheme of the perspective, and subjected besides to unequal subdivision, will all look of different lengths.

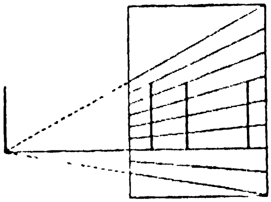

FIG. 19. All the thick vertical lines are of equal length.

ILLUSION NO. 8. Some effects of perspective may now be cited. These will readily be seen to be merely more concrete applications of the illusions already discussed.

At a confined street crossing, where all building space is occupied by tall buildings, any salient angle which is vertical will be readily seen to be so, if the regard of the eyes be directed that way, and by moving about to secure overlap, the verticality of all other quoins and vertical lines can be tested. The retina may have a more or less vertical image of the quoin directly regarded, but all other images of quoins within the field of vision must lean towards that central image on their way up towards the common vanishing-point overhead. If these buildings really satisfied the ambitions of their designers in the matter of infinite height, all the images of the quoins would meet in that point. But the mind, knowing that the quoins stop somewhere and are testably vertical, sees all the skyscrapers with parallel vertical lines.

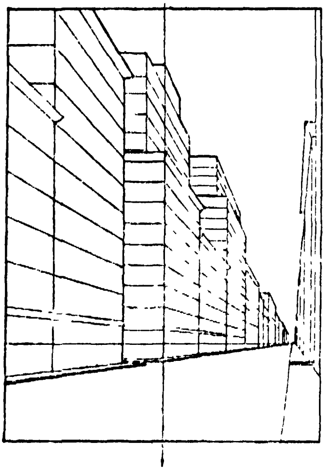

FIG. 20. The vertical quoin regarded is the only one that gives a vertical image on the retina.

Forgetting about the group of quoins rising from the street corners, and looking at one of the buildings, the retina registers a complex group of radiating lines representing courses of stone, string courses, sills, and so on, cutting at a varying series of angles the accepted parallel vertical lines of the quoins. If the near quoin is accepted as vertical, the far quoin leans inwards and curves outwards as it goes up and a peculiar twist or distortion of wall surface is promoted by the series of varying acute angles at which the foreshortened window heads meet the jamb lines.

In concluding this brief review of optical illusions, let us consider the bearing of all this on our immediate problem—the satisfactions derivable from form vision.

Obviously, the retina is indifferent to what it registers, straight or crooked; outlines are neither agreeable nor disagreeable, so far as it is concerned. The whole binocular apparatus may, however, become involved in a certain degree of physical strain when the mind, confused by contradictory stimuli, invokes intense scrutiny.

The effects of illusion are undoubtedly distracting. Thus, where form is the medium of aesthetic activity, dependent on hedonic effects, their avoidance or neutralization may contribute to success; especially so when subtlety of expression in form is involved. The effects of illusion have thus become the object of an artistic technique directed towards their elimination.

Certain illusions, on the other hand, may be invoked artistically to enhance effects of scale and proportion.

VII

THE REALIZATION OF FORM

1. *Form a Function of Mind*

A CLASSIFICATION of form based upon the kinds of interest which form perception arouses may now be undertaken. Full vision is not sensation but mental interpretation, and the feeling of pleasantness or unpleasantness which may accompany form perception can acquire only an infinitesimal ingredient from the organ of sight. That ingredient is a matter of functional ease. It will readily be agreed that a five-pointed star spot is more interesting than a blot spot (unless of course the dispersion of liquid upon impact with a semi-absorbent surface is under consideration). This superiority of the star form to the blot shape is a matter of association, judgement, experience—not one of agreeable stimulation of retinal activity, or of optical muscular exercise. All that the retina demands is the stimulation of adequate light and contrast, while the muscular apparatus is content with health and strength.

Interest in form is inseparable from the interest in things. It is only for interpretation into things that there is any impulse to construct form in the mind. Interest in form may thus be said to originate in interest in things. From the jumbled, changing, duplex patterns on the retinae, the mind selects forms interpretable as things; and takes delight in the exercise of this function of recognizing things as such. Facility of recognizability may thus be regarded as a value. To this end stress is laid in all artistic technique on unity and individuality. Experience is involved—hence tradition in art as a basis for evolutionary progress.

2. *Categories of Form*

In a certain sense, all shape is form—the cloud, the mountain, the waterway, proclaim in their every modulation the handiwork of natural forces. The forms of such objects are generated by material and process in natural reaction. Beetling cliffs, pools breaking into rapids, vapour massing up into the firmament, crystals glittering in the cleft, all have their characteristics of line and detail and silhouette for the physiographer pondering on such things. In these, however, purpose is not felt specifically. Apart from having come about and being there as part of the scheme of creation, the forms of such things may be regarded as an automatic ejaculation of the voice of nature. King David and Professor Geike alike exploit the inspiration they derive from them in psalm and in treatise.

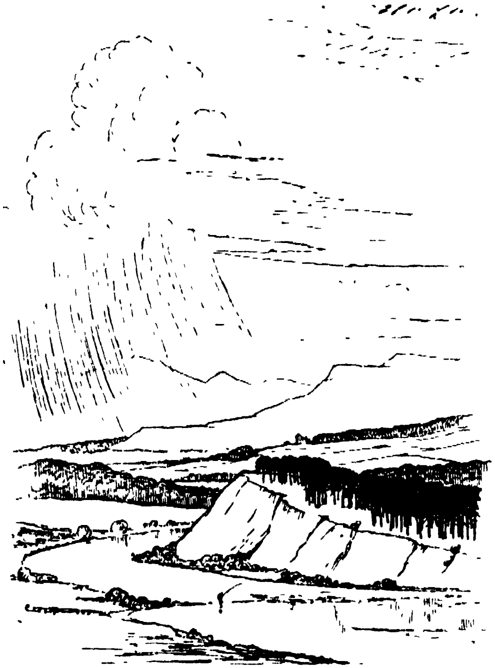

FIG. 21. Inorganic form in Nature.

Let us now pass from the forms of the things which crumble and flow and evaporate and melt, to those of the organic world of things which survive, develop, and evolve by slow processes of generation and adaptation.

The forms of these growing, living, breeding things are still automatically expressive, but specialized function and historical descent and a myriad of interesting accidental considerations of environment account for their infinite variations. Function, however, stands out as the master force at work. 'To live and move and have their being' by repeated regeneration of their species their shapes have tended thus and thus, enriched with minor modulations due to cell, or shell, reacting to systems of nutrition and growth. So your pine tree, your protozoa, and your porcupine in all their parts proclaim a perfect synthesis of purpose, material, and something more which is not essentially very different from human technique.

The works of men's hands, by a similar process of invention and understanding, with respect to their uses and the stuff they are made of, and the means of reducing this material to obedient service, envisage a more or less perfect synthesis of the same elements. Henceforward, by FORM it is this that is meant, in contradistinction to mere agglomeration of shape resultant of conflicting purposes, inconsistent materials, or inept techniques.

Design may now be defined as the discovery of form. The appreciation, nay, the very perception of form, is an intellectual, or if you will, an intuitive process. At any rate it is a mental activity, not a physical reaction. It is not the eye, but the mind, that becomes trained, sensitive, and selective with experience, discarding the misbegotten in plant and animal life, and the irrelevant in church steeples, or the clumsy in table-spoons. And this is all that need be said at the moment on the philosophy of the ugly.

But the main object in devoting a chapter to the perception of form must not be forgotten. What is sought is an explanation of our hedonic reactions to form. So far it appears that no optic nerves are agreeably tickled by cubes, or spheres, far less set vibrating in the sacred presence of parallelograms with sides in the ratio of 1 to $\sqrt{2}$. An intellectual interest in form, as something simultaneously expressive of purpose, material, and technique, all inextricably interwoven in things has been asserted. The synthesis may not always be perfect, but unless it is appreciably there when looked for, the thing contemplated lacks form. Just how to describe its configuration in that case is a matter of no importance to our inquiry.

Now, both in nature and in craft there are certain forms which are generated in many materials under varied natural stresses, or artificial manipulations, and these readily become abstractions. As a thousand different things may be spherical, a sphere can be conceived as immaterial and can be imagined as very nearly so—at least as transcending in interest the stuff it is made of. And so with many other regular geometrical solids, planes, figures, and curves. They can, theoretically, be constructed in perfection, immaterial and independent—spheres, cubes, cylinders, cones, tetrahedrons; hexagons, spirals, helices, conoids, parabolas, and the rest.

Some of these occur materialized in snow crystals, or mechanized in the paths of planets, or incidental in the interpenetrations of turret tops with roof slopes.

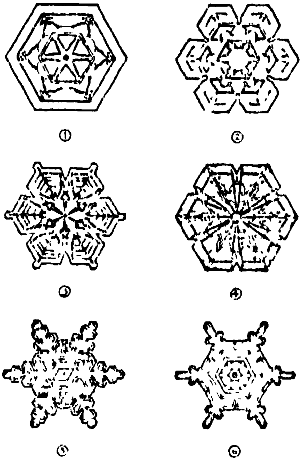

Fig. 22. Snow crystals.

Of these forms it may be said in general that the geometrical basis is comparatively simple or obvious—at least when compared with an analysis of what is going on when a spike of orchid is in process of unfolding its blooms, or a mushroom getting ready to discharge its spores. Geometrical forms may have an interest all their own in virtue at once of their inherent simplicity and the variety of their material incarnations.

In the case of the patterns of the snow crystals and of the many star flowers which in rapid succession adorn the wind-swept moors of Labrador in June, it is the variety and symmetry of the figures that amaze and delight and attract an attention otherwise dissipated by the formless waste of whiteness, or the incoherent jumble of moss, rock, leaf shadows, and general debris.

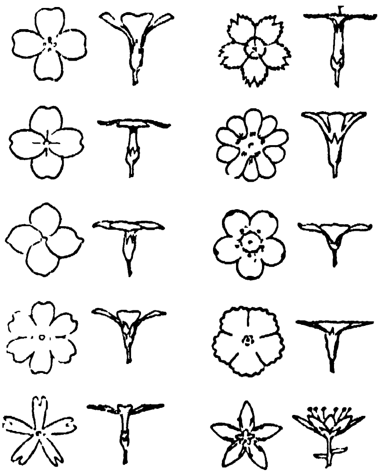

Fig. 23. Rock flowers.

Geometrical, or regular, form has an intrinsic interest, apart perhaps from its underlying mathematics and often apparently distinct from the materialization that supports it. These forms seem so easily to become—especially in architecture—their own subject-matter. The hedonist is apt to infer that they produce agreeable sensations, analogous to the taste of barley sugar, or the fumes of a Havana.

The very basis of design, as an art, is geometric form; but geometric form generated in the solution of a problem, not independent of it. When architectural precepts come to be considered later on, it will be found that pains may with advantage be taken to neutralize those defects of normal vision which the contemplation of regular figures reveals, by introducing such modifications, or 'corrections', as will enable the beholder to apprehend a more perfect regularity than a truly perfect regularity could furnish to him.

3. *Satisfaction in Forms*

Let us now further investigate the satisfactions that may accompany perception of forms belonging to the several categories mentioned above. It is far easier to recognize and evaluate than to analyse and explain the immense and varied delights most of us derive from the forms things take.

In dealing with the inchoate masses of inorganic form one may exclude the interest that derives from the realization of order of magnitude, whatever it may be—pebble, or Alp, or Milky Way; as also that from the recognition of colour—so as to concentrate attention on form only, as the natural resultant of matter and energy in mutual reaction. That form so derived may have generic characteristics will be readily admitted. Dolomites and Grampians have each their own family resemblances, the signs of the law of their being. Then again, rhythmic patterns may be imprinted on tide-washed sands, while the forms of waves in motion are in essence mathematical expressions of physical forces at work. The forms of crystals again, though less readily readable, are expressions of chemical and molecular structure. The patterns of the sky are classifiable into weather portents from the practical point of view. Aesthetically, they may be dramatic contests of floating mass and flowing line—all ultimately recognizable as graphs illustrative of changing densities, temperatures, and humidities of vaporous gases.

The interest or satisfaction of beholding such forms (granted good eyesight, which, like a good digestion, does not obtrude upon the attention) is in such knowledge, intuitive or scientific, as these forms convey. That is to say, there is here no direct element of sensory satisfaction.

Habit and association may, however, invest some mere idiosyncrasy of inorganic form constituting an element in a well-known landscape with all the magic power of a work of art to quicken a pulse. Characteristic shapes of inorganic things recurring half the world away may deal a man a nostalgic blow as arresting as a buffet in the face. But where the shape of a rock is potent to evoke the mysteries of a sad delight, there is a personal equation in the case; in this the shape of the rock figures as an infinitesimal fraction.

The use of the informalities of inorganic forms to serve as contrasts with the formalities of architecture is an old trick of those who choose sites for buildings, and an old trick too of imaginative landscape painters and architectural draughtsmen.

To the mountaineer, the forms that occur in the upper world he seeks are just the symbols of the exercise in which he delights and the atmosphere he craves; while to the yachtsman the shapes of rocks, sand dunes, and headlands will all have a generic interest similarly based. Inorganic form, independently of its colour and scale, can, however, only have a somewhat fortuitous interest. By itself it is hardly susceptible of engendering a more specific mood than the wonder of creation.

Passing now to the organic world of nature, we find form, which is the inevitable synthesis of purpose, material, and process of growth. This category embraces such diversities as the sweep of a lady's eyebrow, the shell patterns of the infinitely ingenious infusoria, and the curve of a tapering frond of fern. In inorganic form there is a riddle to be read; in organic form the riddle is there too, with an added challenge of purpose, to acknowledge which is to open the way to enlightenment and explanation. The delight in seeing organic form is in the revelation of the law we live by—a delight which may wear the mantle of logic, or ethic, or aesthetic, or a mixed and parti-coloured garment pieced from all, or any, of these, according to the make-up of one's mind.

Preference in the realm of organic form is a matter of purely personal idiosyncrasy, for there is no better, or worse, where interpretation and understanding only are necessary to invest each and all with the splendour of the order of the universe. The misshapen and the monstrous, or even the merely typical, can in this sense be the subject of an absorbing interest. The man with a heart that can beat, overwhelmed by the loveliest she his eyes ever rested on, to infer that they produce agreeable sensations, analogous to the taste of barley sugar, or the fumes of a Havana.

The very basis of design, as an art, is geometric form; but geometric form generated in the solution of a problem, not independent of it. When architectural precepts come to be considered later on, it will be found that pains may with advantage be taken to neutralize those defects of normal vision which the contemplation of regular figures reveals, by introducing such modifications, or 'corrections', as will enable the beholder to apprehend a more perfect regularity than a truly perfect regularity could furnish to him.

3. *Satisfaction in Forms*

Let us now further investigate the satisfactions that may accompany perception of forms belonging to the several categories mentioned above. It is far easier to recognize and evaluate than to analyse and explain the immense and varied delights most of us derive from the forms things take.

In dealing with the inchoate masses of inorganic form one may exclude the interest that derives from the realization of order of magnitude, whatever it may be—pebble, or Alp, or Milky Way; as also that from the recognition of colour—so as to concentrate attention on form only, as the natural resultant of matter and energy in mutual reaction. That form so derived may have generic characteristics will be readily admitted. Dolomites and Grampians have each their own family resemblances, the signs of the law of their Being. Then again, rhythmic patterns may be imprinted on tide-washed sands, while the forms of waves in motion are in essence *mathematical expressions of physical forces at work.* The *forms of* crystals again, though less readily readable, are expressions of chemical and molecular structure. The patterns of the sky are *classifiable into weather portents from the practical point of view. Aesthetically, they may be dramatic contests of floating mass and* flowing line—all ultimately recognizable as graphs illustrative of changing densities, temperatures, and humidities of vaporous gases.

The interest or satisfaction of beholding such forms (granted good eyesight, which, like a good digestion, does not obtrude upon the attention) is in such knowledge, intuitive or scientific, as these forms convey. That is to say, there is here no direct element of sensory satisfaction.

Habit and association may, however, invest some mere idiosyncrasy of inorganic form constituting an element in a well-known landscape with all the magic power of a work of art to quicken a pulse. Characteristic shapes of inorganic things recurring half the world away may deal a man a nostalgic blow as arresting as a buffet in the face. But where the shape of a rock is potent to evoke the mysteries of a sad delight, there is a personal equation in the case; in this the shape of the rock figures as an infinitesimal fraction.

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There is this difference between organic and inorganic form, that the former is experienced far oftener with the specific characteristics of generic repetition. The mind thus acquires with respect to the organic a keener critical experience in standardization and comparison. All toads are more like each other than two Alps could be. Our experience of many individual instances of a persisting form tends to create in the mind the typical form, referable to the organism concerned. The relation of the typical to the ideal has both its aesthetic and its hedonic aspects. Organic form is naturally the object of a far closer and more acute scrutiny than is the case where inorganic form is concerned. It is more interesting.

But what of our delight in works of design—discovered form—intentional synthesis of purpose, material, and technique? The analogy between the work of nature and the work of man must be accepted as inevitable. The phenomena of the typical and the ideal and a fastidious, often exaggerated, interest in the 'good example' to the detriment of an appreciation of 'the unique' in design, rest on similar foundations to those on which our evaluation of organic form is based. Two differences may be noted, however. There is a warm human interest about man-made form, very different from the aloof respect, inquisitive wonder, or passionate adoration, accorded to the design and craftsmanship of nature. The fact that men's hearts may glow to us through the works we contrive to present to their inspection is the fundamental motive behind the arts. Then again, while nature's floral and animal monsters are but the exceptions that prove the rule (things of infinite though different interest to nature's beauties, which are expressions of health and strength), man's failures to synthetize purpose, material, and technique in design are of frequent occurrence and result negatively in the ugly. His successes cannot be appraised without experience. To the man who has never worshipped in a church, seen mineral products of larger order than the sand of the sea-shore, or acquired a knowledge of stereotomy, a visit to Hedon Church in East Yorkshire would result only in bored bewilderment.

Now, these several interests we have been considering as appertaining to the contemplation of designed objects have so far all been of a distinctly intellectual order. The sense of sight has been engaged, attracted, stimulated by external phenomena; but nothing more.

Man's work is generally distinguishable from Nature's by an abundant use of simple geometric forms, many of them generated by mechanical process such as turning, planing, and the like, and many invented because man is a neat and geometrically minded animal.

But neither in accuracy nor in intricacy can the geometric forms evolved by man compare with those that sometimes occur in organic nature. The kind of regularity found in daisies, starfish, and sea-urchins is the exceptional; a symmetrical disposition about an axis, as in the structure of the mackerel and the maple leaf, is more usual as a basis.

Perhaps civilized man, in his education from his uncivilized infancy, learns early in life that regularity of form is the sign of the thing of use. In any case, man has an inordinate interest in 'fair work and square work', and in regular figures, plane or solid as such, whether in nature or in things of use.

Although this interest is not due to optic sensation, good sight is essential for readily testing the regularity man craves. A distorted vision may render the appraisal of verticals difficult and the recognition of horizontal planes impossible. Our passion for the vertical and horizontal in structure originates in locomotor convenience, and in experience of structural stability. Thus, though there is no optical satisfaction in regularity so long as the eye functions properly, there is optical distress (strain in the mechanism) with respect to regular forms when the vision is deranged. This distress is not apparent, under similar disadvantages, when viewing the irregular surface of a moorland hill-side, or the rambling lines of an ancient elm.

Regular forms, as already stated, are observably affected by normal optical illusion in a way that irregular forms are not; especially so when they occur at what may be called architectural orders of magnitude. Here again there is something very like negative hedonic reaction in an organ of sense—pain or unpleasantness, but the strain is instigated by the mind not by the image on the retina. In the corrected form, on the other hand, we note something very like a positive hedonic reaction. Indeed, the illusion of a pleasurable *sensation* when contemplating the orderly reiterations of a Doric colonnade, wherein the grosser optical illusions have been ameliorated, is all but complete. In fact there is an infinitely complex mental state, in which the inculcation of an absolute faith in the virtues of Hellenic technique may not be the least potent element.

4. *Form-Vision and Feeling*

Form has been investigated with respect to its origins in matter, under stress of circumstance, and as to its entry into consciousness. What of those judgements of value in form which are arrived at so unconsciously and with such casual facility? The attention can hardly be turned to anything from a planet to a carpet tack without some appraisal of value, some degree of liking with respect to its form. If the retina is indifferent in this respect, assuredly the cerebro-optical apparatus is not.

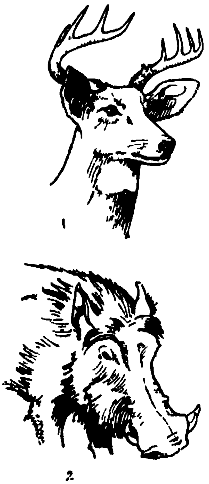

FIG. 24
1. Virginia deer (buck).
2. Wart-hog.

At this point it is convenient to dispose of such erroneous conceptions as are often enshrined in the useful phrases 'pure form' and 'pure design'. The doctrine of aesthetic significance which, if it means anything, must mean that forms have virtue in themselves, bereft of the context that sustains them, to engender states of mind (moods), is here denied. Behind the form there is always the thing itself, or some other thing, from which it borrows an enrichment of meaning. The words 'pure form' and 'pure design' will recur again and again before we have done, but in a very different sense. The purity will mean that there is no artistry there: that we have just what we find in nature and in engineering—solution of the problem in hand in terms of purpose, material, and technique.

For the perception of a form, one requires a healthy eye, an alert attention, and familiarity with the form; or at least with its elements, if it be a complex or novel affair. The hunter sees deer, and the scout sees enemies, because he knows what to look for—shapes and spots which the uninitiated do not fail to record on the retina, but fail to construct in consciousness. Familiarity opens the way to appreciation. The charm of things is primarily independent of their form, which comes to be a symbol of the charm, readily mistaken for the cause. Roebuck and wart-hogs are equally interesting *per se* but, for Englishmen in general, the one is endowed with the romance of sport, and good fare and decorative presentation, and illustrative representation. But Robin Hood and 'his merry men all' have done nothing for the other, and so the wart-hog remains unamiable and grotesque. It is to be hoped that little black boys exist with romantic associations to glorify his slavered tushes and brindled bristles withal, for he is quite a worthy beast.

5. *The Accustomed*

Form, as on occasion the symbol of charm, may be further illustrated by the consideration of classic standards. The value of Doric forms is supported by the whole vast fabric of Greek culture and the historic accident of our inheritance therein. Optical corrections are but a minor ingredient. With equal advertisement the bulbous shafts of Egypt would have enjoyed as perennial a popularity; and that very popularity, resulting in the frequent use of Greek forms, has endowed these forms with an added lustre of standardization.

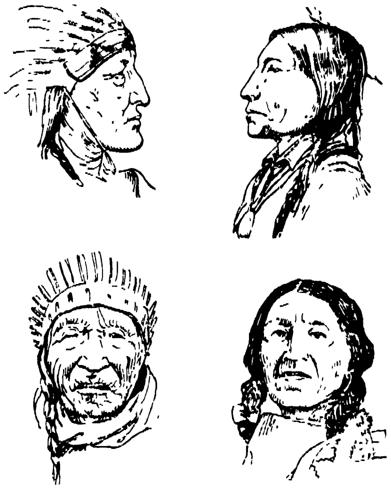

FIG. 25. Western Red Indian types.

That one profile may be as good as another, provided there are enough of each kind available to establish an expectation, will not be readily assented to by a 'lovelorn swain in lady's bower'. Reflection on the races of men may, however, bring enlightenment. In so far as the accustomed form is ever the most readily apprehended, there is a basis in quantity production for the admiration we bestow on classic types. Thoroughbreds, be they young ladies, pigeons, or terriers, appear as freaks to a person with experience of an isolated specimen. But to the fanatic zeal of the fancier successive litters of terriers with noses approximating, ever more closely, to the probosces of the ant-eater may be a source of sheer delight. It is because thoroughbreds, be they princes or peasants, are strong in mutual resemblance that they stand out from the mob of mixed breeds and nondescripts with a generic character which facilitates admiration.

Mid-Victorian Anglicans developed a delighted enthusiasm for pointed windows under stress of a propaganda of nationalistic religiosity, which happily opened their minds to the great virtues of a home-grown architecture of long ago. This enthusiasm resulted in a vast output of vulgarized 'Church Warden' and 'Collegiate' Gothic; but also in a final mastery and revitalization of the tradition at the hands of a few masters—Garner, Goodhue, Tapper, and certain of the Scotts. 'Church Warden' Gothic is, however, the significant fact from the philosophic point of view and, without the support of its apparently vain and inept repetitions, Liverpool Cathedral could not have proved the success it has. If the generic, the accustomed, the typical, the traditional, are at the root of much of the interest in form, on the one hand, we must admit the efficacy —at least so far as the stimulation of the attention is concerned—of the strange, the novel, and on occasion of the extreme and the

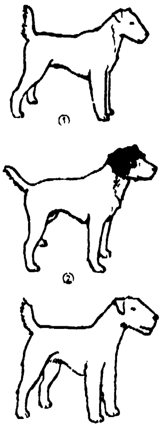

FIG. 26

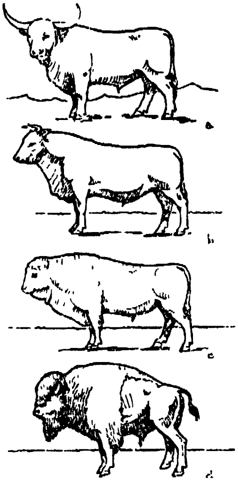

FIG. 27

FIG. 26

1. Wire haired terrier dog in show condition (1903).
2. Wire haired bitch two weeks after weaning, in superb coat (1896).
3. Wire haired puppy overbred and much faked for show (1933).

FIG. 27

a. Highland bull. *b*. Shorthorn. *c*. Cattalo (cross). *d*. Buffalo.

exaggerated in form. But these very characteristics all imply a basic type as a point of departure or comparison. A perfectly new form, one which does not relate in some way to an old one, remains in the realm of the inexplicable, and unless it be associated with some colour interest makes little appeal. Some other sense than sight may reveal it, however. The following extract from an article by G. L. Watson, the noted yacht designer, on the evolution of the modern racing yacht, written in 1894, is illuminating on these aspects of the inquiry:

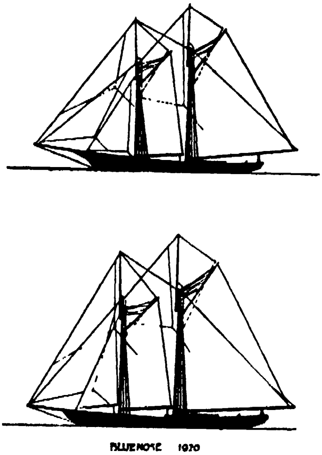

FIG. 28. The evolution of the Nova Scotia schooner. 'Osprey', 1900; 'Bluenose', 1920.

> 'I may mention that the first design for the 90 ton "Vanduara" was drawn with a clipper or out-reaching stem; but I had not the heart to disfigure the boat (as I then considered I should be doing) by building her in this fashion. The rising generation of yachtsmen, however, is entirely reconciled to the clipper bow on a cutter-rigged yacht, and may eventually (though this seems improbable) look with complacency on such outwaters as "Dora's" or "Britannia's".'

It is a fundamental error to suppose that the cheery barbarian does not derive acute satisfaction from his ornate and over-elaborated house, and furniture, that reveal him for what he is. The sensitive ascetic connoisseur, to whom that other's apparatus of life is an abomination of desolation, may surround himself with objects of extraordinary simplicity, yet whose every line is instinct with meanings for him that are hid from his friend's robuster fancy. A cultivated taste does not necessarily bespeak a great zest for the things one likes. The barbarian may enjoy more keenly and quite as conceitedly.

It follows from the above remarks that, on the one hand, forms sanctified by use and habit pass into the current abstractions and symbols of art, while, on the other, art is ever ready to utilize new variations of form as a stimulant. Appreciation of form, and more particularly of form as it occurs in art, is thus seen to be profoundly dependent on habit, tradition, and vogue. These establish the code and the standards which the code enshrines. Forms, like words, wear out, and cease to hold the attention, while new ideas (which are never perfectly new) instigate what are called new and compelling forms. Understanding and communion are impossible between a speaker and a hearer bereft of the common bond of a rich language, but the enrichment of a language derives very largely from foreign borrowings and the absorption of slang. So, with the arts of form.

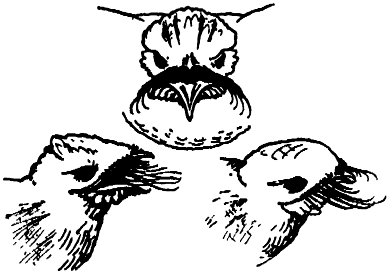

FIG. 29. The nightjar's beak grasps insects without squeezing their blood. The whiskers and mouth combine to form a trap with 'wings'.

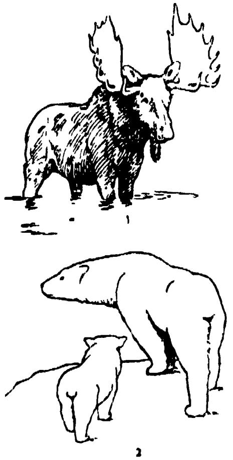

FIG. 30

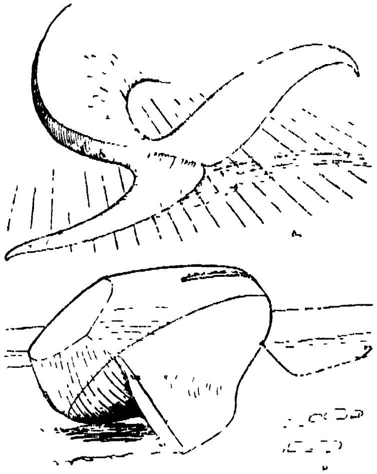

FIG. 31

FIG. 30
1. The Moose. 2. Polar Bears.
Mode of life and environment as determinants of form.

FIG. 31. Stream lines.
a. The tail of a whale. *b*. The underbody of a ketch.

Yet the designers of things, although with manifest inferiority to serene and assured nature, do discover actual form, potential vehicle of 'the beautiful'. When they fail in their synthesis the recognition of such failure, if it is recognizable at all by another intelligence, is the manifestation of the ugly. Such failure in the field of design may result in two or more forms—lack of unity, where one complex form is sought. In architecture, many forms carry an incrustation of thought and feeling over and above their manifestations of purpose, material, and technique; and a too radical new application of an accepted form, amounting to misuse, is a common source of aesthetic failure. All cases of the vapid and the ugly can thus be accounted for. What is ugly to the generality to-day may not necessarily be so to-morrow.

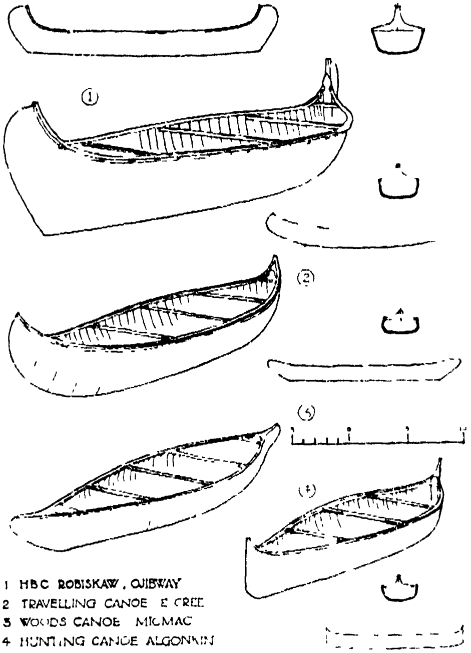

FIG. 32. North American Indian Canoes. Forms of craft primarily determined by the kind of water they ply in, and secondarily by the material available and the method of shaping and putting it together.

Subjectively form is a reconstruction in space, the raw material being direct visual sensation in association with other experience. Objectively form is a special modification of matter under the agency of process in the service of purpose. The shapes of birds and beasts and boats are what they are in virtue of this.

The relation between realization and appreciation of form may be simply stated. *We only see form that is in some sense interesting, and we inevitably derive satisfaction from doing so.* He who 'discovers form'—the designer—only differs in degree of initiative from the observer. One may live twenty years in a city and one may frequent a particular street two hundred days in the year without becoming aware of a particular building till commissioned to pull it down and replace it; and this in spite of an inordinate interest in buildings, and of the fact that the building in question is good of its kind. In such a case, the unobservant enthusiast suffers from so strong a stylistic infatuation that he simply does not recognize form outside the narrow compass of an artificially stimulated traditional experience. Yet within that compass he may see and feel acutely—a Gothic revivalist, an academist, or an 'art nouveautist'—it is all one. Custom and habit have, as it happens, more to do with appreciation than any intrinsic qualities of design.

But it is here that Nature's processes affecting the survival of short-billed pigeons and unbalanced structures come to the rescue. The highest insight of the critic, the inventor, and the artist, all tend to a substitution of new lamps for old, whereby design receives illumination. It is this evolutionary progression in design that ultimately triumphs. Form appreciation may depend on the habitual, but the habitual is amenable to the law of change. Erratic and individual as form preference must be, founded as it is on the shifting sands of individual experience, there is a fundamental basis for design, quite independent of established taste or the cult of the moment.

So much, then, for the enjoyment of form and the negligible part the retina plays therein. Yet it is well to remember that we habitually ignore the indifference of the retina, regarding what our minds have created as wholly objective. Furthermore, we expect other people's minds to be affected precisely as are our own, instead of functioning like ships, loaded with different cargoes of raw material, but sailing on parallel courses. Pig-iron and cotton engender very different behaviour in the same squall of wind. Thus we prattle of 'the beautiful' as if it were a property of matter, assuming that all see what we ourselves see, and with precisely similar enthusiasms.

Part II

THEORETIC CONSIDERATIONS

VIII

SCALE

1. *Various Meanings of Scale*

UNFORTUNATELY the word 'scale' is very often used, even by architects, in several very different senses. The same is true, of course, of many words in our language—'style' and 'proportion' among them. Scale, in the proper sense in which it is applicable to design, is a matter in which the designer has much latitude of choice. In this choice there is something very near to one right and many wrongs for any given case. Once the choice is made, there is an almost absolute right and wrong affecting the sizes of everything, down to minute details, in the interest of consistency. This is so whether the problem be a six-inch hat-pin, or a three-hundred-foot skyscraper. It is not the six inches, or the six times fifty feet that is right or wrong in scale. The size of the pin and of the skyscraper are right, or wrong, the one in virtue of efficiency in keeping a hat from being blown off a head of hair, the other in producing an income commensurate with the investment in land and construction. Their scale is a very different matter. In the case of a war monument there may be no question of practical efficiency, based on accommodation, to dictate size; yet artistic efficiency may demand a certain size (which may be small or as large as the means available will allow).

The designer's meaning of the word is further obscured by such current phrases as 'war on the grand scale', which only means a war in which more soldiers and batteries are used than in ordinary average warfare. The phrase 'gigantic scale' is more in conformity with scale as here under consideration, for the word gigantic connotes giants and scale has something to do with size, even if it is not size, while the two words together do suggest that *everything* about the object which the phrase describes would be comfortable and convenient for giants and far too big to suit mere men. But 'gigantic' is a very poor word wherewith to describe the size of a very big ship, for all ships are in very nearly the same scale throughout their fabric; funnels, engine-rooms, masts, and the envelope of the hull may, however, be large, or very large, when compared with those of usual ships. The impression of largeness which a great liner produces at a near view is, in great measure, due to the comparative smallness of its scale; this it shares with any boat which has a cabin ceiling below its deck—sixty-foot schooners and the like. A ship is from its nature made up of decks; something which those who use historical craft as the subject of decoration very often forget. Turner and Brangwyn have delighted to portray the bigness of ships, and have always appreciated the smallness of their scale as an aid to this end.

To the engineer concerned with pure design, scale is something germane to the problem. He puts big things and little things together, if his problem is made up of big things and little things, and their sizes are determined solely by purpose, material, and technique with emphasis on the economic aspects of all assembled parts. He is not usually interested in how big, or small, his designed object can be made to look, but only in how big it actually has to be in linear, square, and cubic feet. The architect might almost be defined as a person who cares more about how big things look than how big they are. This does not mean that he has an obsession for making everything look bigger than it is, although he may work that trick on occasions.

2. *Phraseology of Scale*

Let us first deal with scales in the original sense of measures by which drawings can be regulated. In small-scale drawings a great deal of detail is of necessity left out which in a drawing of larger scale would have to appear, if verisimilitude is to be attained. Architectural drawing, in so far as it can be regarded as an art at all, is largely a matter of knowing what to leave out, and how to simplify the facts of which the designer is so very well aware. The temptation is to show what he knows, or intends, rather than what can be seen under the conditions the drawing represents, as when the elevation of a large building is shown in its entirety. These conditions involve the assumption of distance between the object and the eye when small scales such as one-eighth or one-sixteenth or one-thirty-second of an inch to the foot are employed to enable large objects to be represented on sheets of convenient sizes from 20 to 60 in. in length. The designer surveying his drawing on his board, two or three feet from his eye, is, so to speak, a hundred or, maybe, a thousand feet away from the object, and, if he knows his business as a draughtsman, tries to show what can be seen at that distance.

The details of parts are later designed and shown to larger scales allowing of more information as to detail. If the designer studies different parts to different scales, he may, while getting each such part right in size with respect to the small-scale general drawing, fall into inconsistency and error of judgement with respect to the subdivisions of these parts. His mechanical process may betray him into getting certain elements of his design 'out of scale' or, in non-technical language, too big, or too small, with respect to other elements. Too big or too small, that is to say with respect to his artistic and possibly also with respect to his utilitarian intention. The practice of developing all details to a homogeneous scale—½ or ¾ or 1 in. to the foot—automatically aids in 'maintenance of scale' throughout the design.

When one uses such phrases as 'out of scale' and 'maintenance of scale' one is no longer talking about arbitrary ratios of inches and feet, but of relative sizes of parts with respect both to the whole and to a general unit. In the case of buildings and furniture, that unit is the size of a man. The architects of the Renaissance period habitually and very wisely kept themselves conscious of this unit by drawing nude figures carrying ten-foot measuring rods, here and there, upon their scale drawings.

The conventional orders of architecture (structurally illogical as they are found to be on analysis whenever employed beyond very definite limits of size, or without regard to material considerations) are of the greatest use as artificial aids for the maintenance of a scale when once it has been established or chosen. On 'choice of scale' more will be said later.

The 'predominant scale' once it is established for a given design may be large or small (relatively, of course, to the extraneous unit, say a man). A large building, such as the Houses of Parliament, Westminster, may be very small in scale, and a small building, such as the Water Gate at Whitehall, may be very large in scale, depending on the choice the artist exercises. If parts of the building are in larger or smaller scale—being parts they are of course smaller in fact than the building—then they are 'out of scale'. Certain impressions and effects are produced by consciously employing two or more scales in one building, but, unless one scale is distinctly predominant, confusion of impression is inevitable. 'Enhancing the scale' of a building, that is to say, making it look larger than it otherwise would, or, in extreme cases, than it actually happens to be, is usually achieved by resort to small scale for some minor element. In Italian palaces, the monstrous predominant scale is often made more than merely evident by unexpected reversion to the strictly convenient human scale in such matters as balustrading of balconies at the level of the 'piano nobile' or main floor.

Contrasting scales, arising in the case of buildings set cheek by jowl on a street frontage, are often unfortunate; usually the building in smaller scale is the sufferer. Mutual enhancement of character by contrasting scales, whether intentional on the part of the builder or not, is sometimes brought about in this way. The Logetta at the foot of the Campanile in Venice and Giotto's Tower hard by the Duomo in Florence, are cases in point where small buildings in small scale contrast to mutual advantage with very large buildings in fairly large scale. The lych-gate with very low beams occurring in the wall surrounding the precincts of the church of Hoar Cross, near Burton-on-Trent, is another case in point. From the gate a startling view of the tall square tower bursts on the beholder, and it seems very much bigger than its prototype at Hedon in Yorkshire.

Cases of buildings which are 'over scaled' are not uncommon. The interior of the Duomo in Florence fails to give adequate impression for its actual size because all the parts of it are relatively too big and simple; there is a consequent 'loss of scale'. The interior of St. Peter's in Rome suffers in the same way. Sir Christopher Wren, the greatest master of scale, perhaps, who ever set out an order, succeeded in making the interior of St. Paul's fully impressive. The recent mosaic decorations, by the way, have gone far to ruin the original effect.

By 'maintaining scale' the integrity of the impression of size is preserved. No device, artifice, or expedient available to the designer is more potent in the interest of unity. When a part is 'out of scale' through being on a scale larger than that which predominates, there is inevitable sacrifice of apparent size in the whole; when smaller there is sometimes enhancement. In either case there is apt to be confusion.

Before passing on to the considerations on which choice of scale is based, 'relative size' is offered as a conveniently short definition of scale, remembering that the 'relation' involves three, not two, things, one of which is complex—the whole, its several parts, and an object of known dimensions external to the design.

3. *Choice of Scale*

Choice in this matter is far from unlimited. The range of choice is conditioned chiefly by use and purpose in any given case. Restricting attention to accommodation in structures for the present, it will be helpful to consider some scales of convenience.

In cruising yachts and pullman cars, their nature demands the utmost restriction relative to the size of human beings; seat heights and leg space are just as in large structures, however. In cottages of the 'but and ben' type, slightly higher ceilings than those in boats and vehicles are possible; staircases and passages may be a little wider; doors less than 2 ft. 3 in. wide and 6 ft. 3 in. high will not be much use; all the activities of cooking, eating, and entertaining, for which 'the rich man in his hall' demands store-rooms, larders, kitchens, pantries, dining-room, and drawing-rooms, will be conducted between four walls, the farthest apart of which may be but 12 or 15 ft. from one another. And so on, rising in the social scale, we get the very small house, the small house, and the house which needs a servant or two to run, and the larger house, and the great house. Each of these is in very many ways bigger and, let us hope, better, till stairways and corridors have become wide enough to admit of passage by more than one person at a time, and doorways attain to the dignity of folding doors. Rooms may then have ceilings at twice, three, or four times the height of a man, and the domestic scale has overlapped the scale required in smaller public buildings and business premises. And so on again; the buildings required for corporate uses demand the scales appropriate to their collegiate, educational, legislative, recreational, and ceremonial functions, ending up with the order of magnitude pervading such monuments as St. Peter's at Rome, or the Bowl at Yale University.

Thus, what may be an outrageously large scale to employ for a monumental gate lodge may be entirely inadequate for handling the design of a concert hall.

Choice of large scale for small buildings is justifiable in cases where the small building is part and parcel of a group of larger building, or occurs in a designed park as a part of an affair of wide open spaces and plantations. On the other hand, a small building, like a small dog, may have a latent interest and charm in virtue of its smallness.

The scale on which a building is designed will generally be right, or normal, when it is such that, without straining practical requirements, the building looks its biggest, giving full impression for its actual bulk. It is fatally easy to rob a building, large or small, of this inherent dignity of size by applying to its design a scale inconsistently large or small. For example, and supposing that there is a question of using orders, these may be superimposed to correspond with the three stories of a structure 80 ft. high; or two stories may be embraced in one order, the odd story, if above, being treated as an attic story, or, if below, as a basement without an order; or the three stories may be embraced in one order. These alternatives may all be feasible with suitable adjustments as to where capitals and bases occur with respect to the heads, or sills, of openings. Sentiment apart, the grandiose order may prove the most, or the least effective in making the building look its size, when its surroundings, or adjacent structures, are taken into account. Then again, the width of the bays may be such that one or other of these treatments is most effective; or this condition may rule them all out.

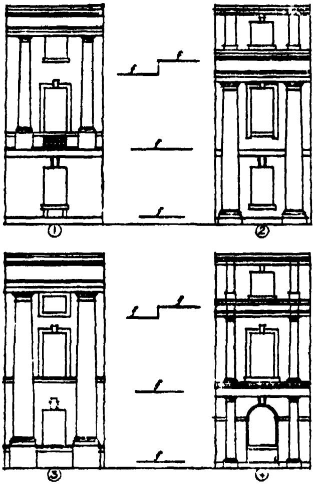

FIG. 33. The employment of the orders for scale.

Order embracing: 1, two upper stories; 2, two lower stories; 3, three stories; and 4, separate orders for each story.

Next, suppose a monument consisting of a chamber surmounted by an order carrying a cupola surmounted in turn by an urn; and suppose that all main dimensions are fixed even to the height of the columns. It is still open to the designer within a fairly wide range to choose a scale, and whether it is the best in the circumstances will still depend very considerably on the surroundings, or site. A promontory on a lake amid rugged rocks and heavy timber, a confined square or courtyard surrounded by buildings, the end of a vista in a garden, may each furnish good reasons for a preference.

Scale is not insensitive to material. The finer and softer materials are more readily modified. Dark materials are less responsive to light and shade than those of light colour. The case of material obtainable only in small pieces, such as the stone available to the medieval Gothic cathedral builders, or of material readily available in large blocks, may be a consideration. Theodoric's tomb at Ravenna is a very small building on a very large scale. The monolithic dome, whose weight has pressed the whole structure deep into the mud, is the determinant of its every detail.

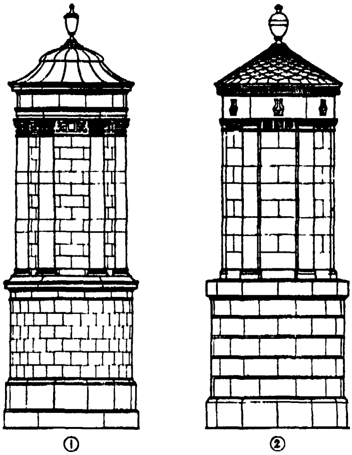

FIG. 34.

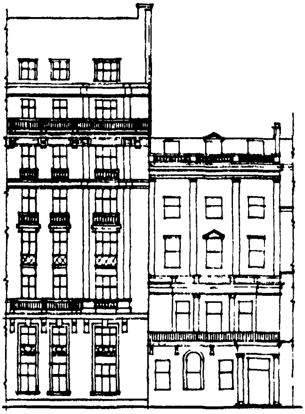

FIG. 35.

FIG. 34. The same problem solved on: 1. smallest compatible scale, and 2. largest compatible scale.

FIG. 35. Adjoining buildings in conflicting scales.

The unregulated street architecture prevalent in English-speaking countries no doubt owes much of its interest to its freedom, but this freedom is prolific in clashes of scale. In city architecture, respect for the scale of what has already been built might well be a consideration when exercising choice. Urbanity has something of mercy in it, and mercy carries a double blessing.

In the case of an institutional group of buildings, all differing in size and in use, the most ready and elastic means of emphasizing their group relationship is by a rigorous maintenance of the scale, once it has been established.

The sky-scraper builders of Manhattan have one and all done their wicked best to compete for attention with rival scales, as well as rivalling sizes, and their efforts would be far more disturbing and dissipating than they actually are but for the fact that the raw material of their compositions consists of homogeneous units of office accommodation. Yet lower Broadway, like the attorney's 'elderly ugly daughter', can look very charming in a half-light with enough haze to reduce its monstrosities to silhouette while still letting the myriad window dots tell their story.

4. *Examples of Choice of Scale*

A clashing contrast in scale, where there is something really worthy of expression by recourse to so dynamic and arresting an expedient, may be all to the good. St. Peter's, towering serene and immense above the sea of roofs under which the infinite complexity of human life is carried on, gains enormously by their spreading contiguity which offers so ready a measure of its own bulk.

But suppose that St. Peter's, surrounded only by a few acres of villa development, was set three miles away in the open Campagna; what a fatuous affair the combination would be!

Choice of scale may be dependent on a specific available point of view. The Opera House in Paris is a case in point. There is a superb piece of street planning leading up to this notable composition which bristles with difficulties of scale adroitly overcome. The questionable quality of its lavish scheme of decoration need not trouble us here. The building is seen intimately from the open space and streets adjoining it, but also as closing the vista of the Avenue de l'Opéra. The dominant scale is set with reference to the large unbroken element which houses the stage loft; and this scale runs through the whole fabric in a broad way. But the lower stories have a minor scheme of subdivision designed to impress the passer-by. All this is lost, as it is intended to be, in the distant Avenue view of the thing as a whole. There are, however, intermediate points from which a distinct rivalry of scales is felt. That is to say in certain views the building lacks unity of scale. Such an expedient can rarely be wholly successful.

The Russian Commercial and Industrial Bank on the Morskaya, St. Petersburg, founded on the design of the Gran Guardia at Verona, and an at least equally successful building of large size on a very large scale, is designed to be seen from the street. The façade is on a superhuman scale throughout, to which the doorways and wicket gates at the street level furnish the key. If this building stood by itself in open surroundings and could be seen from a distance of a few hundred yards, it might readily be assumed to be only half as high and half as broad as it is. There are cases where simplicity combines with consistency to render it almost necessary to rub one's nose on a plinth before realizing the size of large-scale work. But, when that undignified manœuvre is accomplished, or surroundings render it unnecessary, then behold the splendour of realized size.

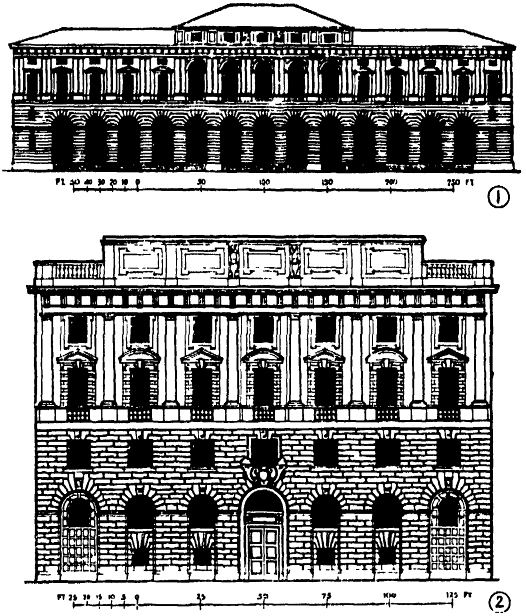
FT 50 40 30 20 10 0 50 100 150 200 250 FT
①
FT 25 20 15 10 5 0 25 50 75 100 125 FT
②

FIG. 36

1. The Gran Guardia, Verona, by Curtoni, pupil of San Michele.

2. The Russian Commercial and Industrial Bank, St. Petersburg, *c.* 1900. School of Ludwig Hoffman. The later building is modelled on the earlier. The ground-floor arcades are approximately the same height.

5. *Maintenance of Scale*

Medieval buildings of the middle periods, for all their individuality, inventiveness, and almost personal idiosyncrasy, were generally speaking intensely systematic in their architecture. Whether one regards the external unit as a two-foot rule or a six-foot man, the builders seem always to have kept very conscious of it. In these buildings—setting aside the miniature decorative architecture of canopy work where the scale of parts was from about one-tenth to one-twentieth of the normal—the scale varied very little throughout the elements of the fabric, no matter how large or how complex; and only within a range of about one to two as between very small and very large buildings. The primary mullions of the main windows of the Wayside Chapel of Houghton-le-Dale, Norfolk, are 1 ft. 9¾ in. centre to centre, those of the east window at Heckington, Lincolnshire (a fair-sized church) 2 ft. 6 in. centre to centre, and those of the great west window at Guisborough Abbey 3 ft. 6 in. centre to centre.

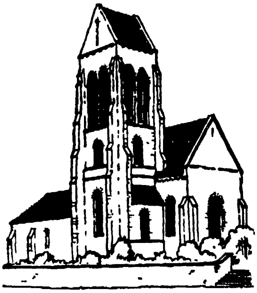

Fig. 37.

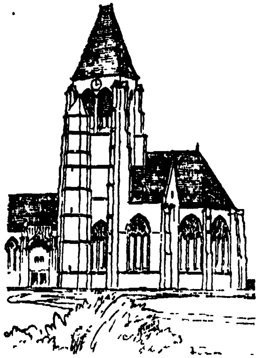

Fig. 38.

Fig. 37. Early French Gothic tower, designed without artifice for scale.

Fig. 38. Late French Gothic tower made to look taller than it is by the artifice of horizontal subdivision.

There was more latitude of scale in English thirteenth-century work than in these later examples; and, generally speaking, more in French, German, and Spanish work than in English; but the fact remains that *the four- or five-century long Western European tradition*, which has to its credit the most amazing realizations of size as an element of architectural impression, achieved its effects with, or perhaps because of, a very limited repertory in the matter of scale. While it is true the medieval architect treated members and ornaments occurring high up broadly, yet the intention was to have them look not very different from those near to the eye. The big thing was made up of much the same fabric as the little thing: the spire had very pronouncedly more crockets, but only slightly bigger crockets, than the pinnacle. In Gothic art, man does not ape the work of giants—not even when mighty fortresses against the Infidel are the matter in hand. There is more range of scale in medieval decorative figure sculpture than in medieval architecture. Yet the Devil of Notre Dame (a restoration which there is no reason to suppose differs from the original in this particular) is about life size; the Christ between the doorways of Amiens is not twice life size; the figures flanking cathedral doorways are usually about 8 ft. high; the David high aloft at Rheims measures nearly 13 ft. head to toe; and minor exterior decorative sculpture is rarely less than a quarter life size.

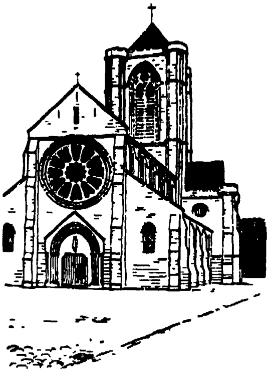

FIG. 39.

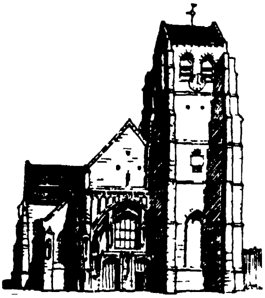

FIG. 40.

FIG. 39. This fourteenth-century tower gives full impression of size without recourse to trickwork.

FIG. 40. The short belfry windows contrast with the height of wall below, which is accentuated by the horizontal subdivisions.

These are matters which North American medievalists would have done well to ponder. Their habitual lapses in matters of scale proclaim an ignorance of basic principle engendered by a knowledge of another method which, though 'a very good way too', is unfortunately not compatible with the Gothic system.

In medieval tower design the minor detail often becomes simpler and coarser as one goes up, while the major detail tends to become stronger and crisper as one comes down. Thus, while buttresses and openings decrease in force, stage by stage upwards, the finials, crockets, and mouldings increase slightly in size and simplification so as to remain legible.

Taken by and large, the Gothic architects may be said to have maintained scale in a general way throughout all their operations with a persistence unknown to other traditions. In the later phases of Gothic architecture, and especially in England, there was a positive obsession for what may be called scale-giving tricks. The overlaying of wall surfaces with panel units was the most common device.

6. *Interaction of Scale and Proportion*

It may here be observed that the interaction of scale and proportion is manifest in all highly developed architectural systems. When reviewing optics, it was observed that proportional contrasts tended to the enhancement of the characteristics of the contrasting elements. An element may thus be made to look proportionally taller and therefore bigger than it otherwise would or actually is, and vice versa. That is to say, proportion may often have an influence on matters of relative size. Scale and proportion are often, perhaps always, interdependent to some extent. Whether the artist be scale-conscious or proportion-conscious, he must to some extent use proportion to serve scale. These two things cannot be defined in terms of one another. If scale can be regarded as the product of proportion, yet proportion must often be the servant of scale—the case of a mother combing her daughter's hair.

Some remarks may here be hazarded as to the respects in which the Greeks were sensitive to scale—they who, by the accidents of history imposed their proportions on thirty generations of designers. That they would consciously have attempted anything so unreasonable is hardly to be supposed. In matters of scale they taught their successors nothing.

Greek monumental architecture was chiefly generated in the building of temples of several distinct sizes. Of the secular architecture we know little, but may assume that widely spaced columns and wood entablatures were its common ingredients. One need hardly consider the very great temples of the class from 160 ft. to nearly 200 ft. wide and sometimes about 400 ft. long, for these (mostly Ionian) were few and on the whole rather incongruous, as giants usually are. The characteristic small temple had few parts.

There were often, in Doric examples, two columns between the ends of the walls where in small Ionian temples there would be four in front and rear. The larger temples, usually from 80 ft. to 90 ft. wide and about 200 ft. long, were for the most part based on the same plan as the small temples, but enlarged and elaborated, and were furthermore surrounded with columns. If there were eight in front there would be sixteen or seventeen on the side, and if six in front then twelve or thirteen on the side. Inner porticoes are not unusual and double peristyles are sometimes to be found.

Columns and entablatures of practically similar form may be found in temples of all the sizes built, but the larger temples were not, as just noted, small temples enlarged; they were more complex organisms. The rule of column spacing appears to have been one diameter *plus one cubit* apart for temples of about the size of the Parthenon, and for the smaller ones. That is to say, relatively to their diameters, the columns are spaced farther apart in the small temples, but actually nearer together. If the columns in the small temples were the same number of diameters apart as in the larger, there would not have been enough room to pass freely between them; and if the columns in the larger had been the same number of diameters apart as in the smaller, they would have involved longer, deeper lintels than could conveniently be got. Use and material thus had their say. The extra cubit ensured efficiency.

Doric columns varied greatly in their proportions during the period of evolution, but became nearly standardized in the period of the fully developed Doric tradition. The interesting point is that the Greek architect then adhered to conventional or standardized proportion in some things but not in others. The larger porticoes were not enlarged small porticoes, although their large columns were practically enlarged small columns. Once they had established the size and organization of their designs they relied on conventionalized or standardized elements to maintain the scale inherent in the object.

This they nearly always did, and their success in maintaining scale throughout each of their very simple temple problems is incontestable. But what of their success with scale in designs where problems of greater complexity than mere simple oblong units with low-pitched roofs and one exterior entablature level were concerned?

Admitting that the Doric order in the hands of an ancient Greek was a far more elastic thing than ever it became in the hands of a Scottish, or German, Greek revivalist, it may be contended that some of these latter-day saints and prophets had a fine sense of scale that would have been justly outraged by the production in their own day of buildings with the glaring faults of scale one finds in the Propylaea and the Erechtheion. In both of these examples, maintenance of proportion, the very instrument the Greeks could rely on for the maintenance of scale in simple cases, has turned against him.

Then what of those aggregations of temples, great and small, which grew in colonies upon the holy places of ancient Greece? Because each was usually endowed with all the unities it does not follow that they are mutually compatible. Greek taste was curiously obtuse as to incompatibility of scale, a matter on which Gothic taste was, if anything, hypersensitive. For all the elaborate writings and drawings on the subject there was no 'ensemble' on the rock of the Acropolis. At Durham or at Mont St. Michel nothing is allowed to detract from the 'ensemble'.

If an ancient Greek architect could come among us to-day he would probably be able to enlighten us considerably on proportion; the more so as he would have the advantage of being free from four centuries of misdirected zeal on that subject; but he would find much to learn about scale from work after his time. The Greek architect, with his ecclesiological interest limited almost entirely to temples either about the size of that of Nike Apteros, or about the size of that of Pallas Athena, building and rebuilding on sacred sites up to Alexandrine times, had little concern or opportunity or interest in problems on other scales. In group design he was a child.

7. *Scale in the Human Figure*

The human figure has been invoked by the proportionists time out of mind and again and again. Let us invoke it as scalists, taking Dr. J. B. S. Haldane's 60-ft. giant as our example. This lusty child of the professor's imagination was born to elucidate the functional significance of size. He was assumed to be made of ordinary flesh, blood, bone, and fibre, and to be the shape of an ordinary man. Then it was proved of him that he would collapse if he moved; his weight would be measured in tons. It would be interesting, still assuming that he was of ordinary flesh, blood, bone, and fibre, all of high quality, to find out what shape his legs and arms and several parts would have to be so as to enable him to show some activity without bending, bulging, and collapsing. Or better still, assuming that he was the shape of an ordinary man, to find out what his bones and muscles would have to be made of. Size, material, and form are interrelated matters and normally form is a resultant. When form is constant, irrespective of size, the material requires modification out of respect to size.

A 60-ft. man, at a certain distance, in certain surroundings, and under certain illumination, might be mistaken for an ordinary 6-ft. man. But if he wore a well-fitted kilt, woven in a tartan of the ordinary size, either the cloth would look miniature or the man would look the 60 ft. he was. Scale would be given to him by the introduction of an exterior element of known size.

8. *Limits of Size*

In design every structural system has its upper and lower limits of application, and the classic orders are no exception. It happens, however, that they have never yet been attempted on a scale which endangered a stone column by crushing from its own weight. Orders of moderate size, however, have been loaded in American construction above this point through the artifice of steel cores in the shafts and steel beams in the entablatures, a matter more interesting in reference to proportion than with respect to scale.

In the post-hellenic classic systems the scale varies with the size of the order, independently of the size of the elements of the building or of the building as a whole; such sizes are, of course, determined by use. The virtue of these admirable conventional systems is that they provide in themselves a scale ever consistent with the members, but relatively less when used in large than in small buildings. Impression of size, when orders are used, is largely dependent on the introduction of the human scale for comparative purposes related to selected parts. This is a more complicated device than the medieval one of approximately fixed units.

Each system has its advantages and its appropriate occasions; and they are not wholly incompatible in combination. In modern architecture these systems are rarely used purely and apart, for we moderns are the heirs to all the ages, even when we most persistently acknowledge only some one branch of our cultural ancestry.

Now design, as an art, without reference to scale is almost unthinkable. Things may be designed with reference to size only—

to tell their own story. But design, as an art, usually makes things tell a good deal more than their own story by adding comment as to how the designer feels, and wants others to feel about them. Be the designed object great or small, its size is one of the most elemental things about it that impresses the artist. This he realizes through the artifices of scale, both for himself and for his public.

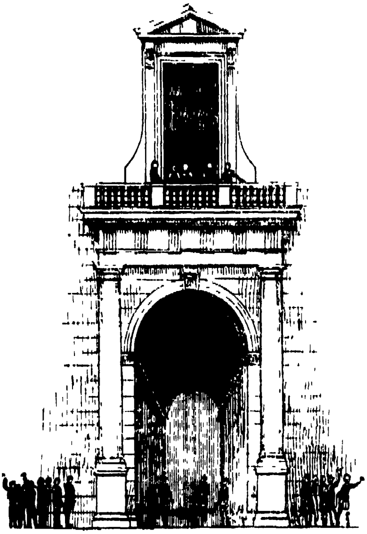

FIG. 41. This archway and conventional order, conceived to convey gigantic impression, would give no sense of the actual size without the human scale balustrade. (The persons indicated on the drawing further help the impression.)

After all that has been said above, it may be well to repeat that there is some latitude in determining the fundamental scale of a design; here right and wrong have their limits only in what is reasonable and practical; but once the fundamental scale is established there is a very definite right and wrong with respect to the sizes of all parts and minor elaborations, whether the design be redolent of tradition, or brought down out of the blue.

IX

PRECEPT IN PROPORTION

1. *The Astrology of Art*

GIVEN due time, nature has a kindly way of adding to the charm of buildings. Frost-cut joints, weather-worn mouldings, and clambering vines, like the wrinkles on an old wife's face, bear witness to the vicissitudes of life which mankind and buildings share in common, hinting, sometimes misleadingly, at the splendours of a time when the old face bears a bridal veil, or the old building's 'new cut ashlar takes the light'.

But, given due time, it is extraordinary what the busy brain of man can accomplish in spinning cobweb theories, which enshroud the perfectly natural intentions of the designers of the past when they were determining the dimensions of the several parts of their structures. It is perhaps too much to hope that Mr. Hambidge should be the last of the long line of architectural astrologers who have achieved fame through exploiting that mystic faith in perfect numbers which has impelled them—all for the supposed benefit of future designers—to spin webs of circles, diagonals, triangles, squares, and parallelograms over the elevations of ancient buildings. For the most part the proportionists, from the time of Vitruvius onwards (with a rather noticeable gap during the Middle Ages when common sense gave short shrift to sorcerers and the professors of witchcraft) have been obsessed with the hope of extracting recondite formulae for design, transcending and superseding the inevitable control of purpose, material, and technique. All real designers have felt these inevitables in their bones; and few have considered it worth while to put the matter down in words while it was open to them to put it into stone or wood, and they —ancient Egyptians and medieval Frenchmen alike—when doing so have naturally had recourse to simple geometrical figures in setting out their work so that things would fit.

But it would be a mistake to assume that many able designers have not lent an ear, often a willing ear, to the professed proportionists, or to suppose that the designers who have done so have failed as artists. It may be contended, however, that these have often succeeded, not because of, but in spite of their readiness to believe what they could not understand. This phenomenon is not unknown in other walks of life, as all history bears witness.

The modern student of the arts of design has to be put on his guard, whether his immediate object is artistic appraisal of what has been built in times ancient and modern, or the search for principles for his own practical guidance as an artist. A little sweeping of cobwebs is in order if we are to see ancient buildings in the clear light and shade of observant common sense. For it is on ancient buildings that the filmy webs of the proportionist hang thickest. It is better to remove them than to try to see through them.

2. *The Greek Architects*

It is a common error to suppose that the study of Greek architecture is imposed upon the student for the sake of its perfections. Its proved usefulness to the student is dependent rather on its rudimentary qualities and limitations. A Greek house consisted of a rectangular plot with a colonnade thrown round it, off which the rooms opened; a plan that survives in many a bleak northern cloister as evidence of the defiance of logic by tradition. A Greek temple consisted of a rectangular room with a colonnade thrown round it on the outside, a form that survives in many a bank and bun-shop, in defiance of common sense. The interior of the larger Greek temple and the area of the Greek market-place were flanked alike with a two-story colonnade. The Greek theatre was quarried from a hill. There was planning, but there was no planning problem as we understand it to-day. Hence the simplicity.

The state of technical skill enabled the Greek to use stone columns built of drums derived from quarries of superlatively good material, of sizes convenient for shafts from 15 to 60 ft. in height, 35 ft. being the normal size in large-scale work. Such columns did not carry ten-story buildings, but were loaded only with a mass approximately equal to their own. Stability against earthquakes seems to have been the aim. Within such limits of scale there was obviously no approach to the structural limit of the material—there was structure, but no structural problem as we understand it to-day. The sectional area of the pier was determined by consistency, not by actuality. The Greek had no means of testing his materials to breaking-point. Rule of thumb was a sufficient guide for construction, directed against stability rather than stress.

Then again, to the Greek, architecture in stone, when it went beyond the mere erection of walls, was a species of monumental luxury or, at best, of pseudo-rationality—a defiance of the economic. So we have the phenomenon of 600 years of effort, partly conscious, probably mostly unconscious, in translating a once real and live system of design for wood into an artificial, crystallized, irrational, but marvellously self-consistent version in stone. It is this consistency that renders Greek architectural forms so digestible a pabulum for the student mind. A condition for this consistency was the absence of high complication in purpose and structure. In a word, for centuries your Greek architect, though busily employed, had nothing much else to do but polish the phrases of his insincerity and attend to the permanence of the medium in which he recorded it.

Now the very cultured gentlemen of the time of Pericles who concerned themselves, for a living, with this embryonic architecture, were rubbing shoulders with professors of music, in the wide Greek sense of that word. These masters of rhythm, who dealt in time and measure and number as their stock in trade, had in consequence a very real, though quite fallacious influence on the neat adjustment of the rules of thumb for building.

The Greek architects worked in close co-operation with the sculptors who were busy seeking that illusive will-o'-the-wisp, perfection of human form, which they did, with an interest never bestowed before, or since, on this alluring chase. They developed a passion for intensified standardization comparable to that of a Midland fancier of fan-tail pigeons. In evidence of all this, in the third and fourth centuries B.C. when the most goodly forms of men of thirty and women of twenty-five were being petrified to our lasting delight, the forms of old men, young maids, and chubby children escaped all scrutiny: or so it would seem, to judge by the few lamentable attempts to represent them in marble. Niobe's children are just little women, as the orders in the wings of the Propylaea are just little versions of those of the main portico.

3. *Vitruvius*

So the Greek architect built very gloriously within the limits of his incentives and he sometimes left behind him a treatise on his art. None of these treatises are extant. But it is certain that Vitruvius, writing probably in the time of Augustus, had knowledge of several such works. He wrote ten books on 'architecture', the majority of which dealt with matters of civil and mechanical engineering, and of these the third deals with proportion in building.

It is thus necessary to consider with some care what this author would be at. Three things are requisite to the reader of Vitruvius, besides some acquaintance with the Latin of the Augustan age, which is commonly taught in schools—a practical knowledge of building trades, some familiarity with the remains of classic monuments, and a little insight into the state of knowledge in the ancient world.

Now a practical understanding of the building trades is the thing most frequently absent in the intellectual equipment of the many translators of Vitruvius. As a consequence much of his rule of thumb building construction has been mistaken for aesthetic doctrine and, being wholly incomprehensible as such, its author has, by accident, achieved the halo of profundity. He was such a simple-minded old gentleman, hyper-conscious of his virtuous professional respectability and wholly lacking in the gift of imagination, scientific or otherwise; but he was an acute though superficial observer.

There was, by his account, a considerable body of literature dealing with the setting out of temples; for he waxes garrulous at times as to the authors he has read and, very possibly, misunderstood. There is no evidence of his ever having seen a Greek temple, or having gone so far afield as Paestum, and he took no interest in the splendid achievements of the younger generation of architects—many of them Greeks—who were beginning to solve the problems of design which Imperial Rome was setting for them.

Vitruvius establishes the precedent for losing one's way in writing on proportion. He tells us naïvely: 'These rules of symmetry were established by Hermogenes.' It is not at all clear whether the rules referred to were in the original intended as rules for construction or conventional canons of form. The former view is supported by such remarks as this: 'In Areostiles' (colonnades, that is, with the pillars spaced at 5 diameters centre to centre) 'we cannot employ stone or marble for the architraves, but must have a series of wood beams upon the columns.' This is solemnly stated with no hint as to the scale upon which these colonnades might be erected or as to the superincumbent loads involved.

Is one to consider this sort of thing as elementary, or rather embryonic, theory of structures, or as abstruse and very subtle hedonic precept? There is much to be said for the former view. Vitruvius farther on recommends that the wider the spaces between columns, measured in diameters, the thicker must be the shafts: that is to say, the stumpier must be the proportion of the columns (or is one also to determine the heights of the columns by the width of the passage-way between them?). He cites no rule of relation between the masses of piers and the loads they carry. On the contrary, he gives as his reason, that the contrast of the wider void makes the column look too thin. Whatever was the intention of the writers he quotes, he at least had here in his mind's eye a standardized column for each order, an 'aesthetic ought' of a kind more rigid than any Greek before him, or Roman of his time, had yet ventured to embody in stone. And this conceit of the column that should look 'just so' was to be modified by thickening it when so placed that seen against the background it would be affected with an apparent diminution due to halation, or else by increasing the number of flutes when so situated as to have a reverse effect. The column was to look 'just so' even if it had to be made otherwise to achieve that important end. Vitruvius thus shows himself a keen observer of optical effects and illusion. Granted his premisses, what could be sounder than his advice to taper larger columns less than smaller ones on the ground of the more marked perspective diminution in the case of a near view of the former; or his admonition to overcome the effects of foreshortening by increased projections in the capitals.

One should not, however, expect in Vitruvius a higher standard of scientific thought than was common in his day, when spontaneous generation was assumed in the case of those insects whose larvae were small enough to escape notice, and whose families did not consist of a papa, mama, and the babies.

When Vitruvius wrote his third book, dealing with symmetry and proportion, he was merely showing how to set out and construct simple colonnaded one-story buildings, varying from about 25 ft. × 40 ft. to 200 ft. × 400 ft. on plan with the columns varying from 15 ft. to 60 ft. in height, that is to say, buildings with a range of about 1 to 10 in size, constructed of members ranging in scale from 1 to 4 only. His intention was apparently scientific, yet he fallaciously assumed that any two fragments of post and lintel construction were equally right and proper, structurally, if similar in *formal proportion*, whatever might be their scales and the resultant structural problems.

The old specification writer, for that was his strong suit professionally, had certainly read some Greek works upon a building tradition centuries old in his time. This tradition he was trying to reduce to an exact science.

Incidentally, one must credit Vitruvius with the most successful achievement on record in the perversion of human judgement, for the theory of proportion in buildings, from his day to this, has been built upon the insecure foundations of an argument on structure in which formal is confused with functional proportion.

4. *The Later Academicians*

The hold that these theories obtained over the better judgement of really competent designers is well illustrated by the vapourings of Serlio, writing in his *Five Books of Architecture* about 1525. Discoursing on the remains of the Theatre Marcellus, which, like the buildings of its time, was distinguished by some minor idiosyncrasies of detail, he says:

> 'I am of opinion therefore (by licence of these and other antiquities) that a workman in these days should not make a mistake (by a mistake I mean to do contrary to the precepts of Vitruvius . . .): because it is not sufficient for him to say "I may do it for ancient workmen have done it" without consideration as to whether it is proportional to the rest of the building.'

And we find a similar spirit in the deliberations of 'L'Académie des Architectes du Roi' in 1672, when, after weeks of discussion, it arrived at the sapient decision that Scammozzi should be followed *en gros*.

Professor August Thiersch[1] has, by laborious research, uncovered something of the method of Greek temple builders in the matter of setting out their work. If he also discovers some proportional relations of which one cannot admit the existence, and others which exist by obvious accident, at least the inconclusive nature of his contribution to the 'astrology of art' goes far to disarm criticism. He sets out with the stimulating assertions:

'There are rules for architecture by the observation of which beauty is attainable and through whose neglect it is diminished. The discovery and formulation of these rules is a task for science to deal with. . . . Everybody knows that for the attainment of beauty in a building good proportions are essential. . . .'

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[1] *Handbuch der Architectur.*

He then proceeds to cite a number of examples of classic architecture subjected to the proportionists' analytical methods. From these he derives neither deductions for our information, nor precepts for our guidance, unless a half-hearted credo on the 'golden section' can be so regarded. Thus while one may concur in the truism that there are rules of architecture, one must decline to this inquirer the credit of having discovered them. An unqualified admission as to the use of perfect numbers and mystic circles in the setting out of the plans, cross-sections, and end elevations of Greek temples is, after all, quite consistent with the view that these practices had nothing whatever to do with the aesthetic qualities so manifest in these works of design.

5. *The Proportionist at Work*

Let us investigate the method of the proportionist at work. Take the cases of the Tower of the Winds in Athens, and the Pantheon in Rome. On elevation drawings of these buildings one selects as a basis, in the first case, the doorway, and in the second the portico, and crosses the rectangles so selected with a diagonal. By following the very arbitrary geometrical constructions of the professor, one reaches the following conclusions. In the case of the Tower of the Winds, the frieze and cornice bear to the whole height of the building the same proportion that the architrave, frieze, and cornice of the doorway do to that element. What then? In the case of the Pantheon the portico without the pediment is shown to be a rectangle similar to the figure presented on the drawing by the projected elevation of the main drum of the building, which can never be seen except as a drum in perspective with an elliptical curve on the sky-line. What wonder that our inquirer hesitates to draw conclusions and enunciate precepts from such discoveries.

In the case of the Tower of the Winds, what possible analogy of form and relation can there be between the rectangular porch with its superstructure, and the octagonal main element and its crowning members? And in the case of the Pantheon, what ocular, or mental, satisfaction is to be derived from a proportional relation that no one could apprehend, or even suspect, without the measurements before him? Is architecture brought about to be measured, or to be contemplated? And in the case of the Pantheon, was the inquirer not aware that the present portico was added, probably after removal from another building, many years after the rest was complete, and did he not realize that the crown of the drum is where it is because a certain amount of weight was required on the haunch of the dome in the interest of stability, and that the position of the spring of the dome is determined by considerations quite divorced from those determining the dimensions of the portico?

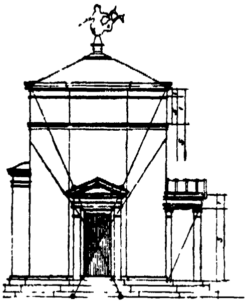

Fig. 42.

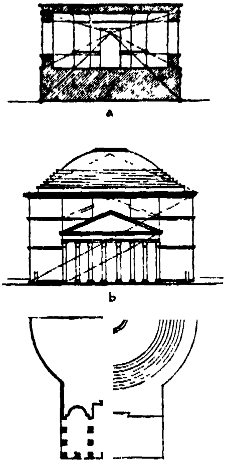

Fig. 43.

Fig. 42. Analysis of the proportions of the Tower of the Winds at Athens, *Handbuch der Architectur*, ed. 1904, iv, p. 54. (See also Fig. 52.)

Fig. 43. *a*. A proportional analysis[1] of the Mammisi Temple, Egypt, establishing analogy of form between the chamber and the platform with its peristyle.

b. A proportional analysis[1] of the Pantheon, Rome, that is meaningless, both on geometrical and historical grounds.

[1] From *Handbuch der Architectur*, ed. 1904, iv, pp. 49 and 58.

In the simpler cases, such as temples, façades, or repeating bays with fenestration, such researches are conducted after this fashion. A diagonal is laid down crossing the wall of the cells, or extending from outer base on the left to outer cap (or top of cornice) on the right. Parallel diagonals are then sought embracing the building as a whole, or a decorative order, or the minor elements such as openings. Now a very great deal of the success of these operations must depend on just where the diagonals are laid down and the points they pass through: the top of the cap over the centre of the column, or the top of the cap at the profile: the intersection of the top line of the frieze, or that of the top line of the cornice with the centre line of the column. Plinths and bases and even stylobates may be included with, or excluded from, the elements surmounting them at the discretion of the artful practitioner. A little selective adroitness is all that is required to discover the most astounding unsuspected proportional relations—relations which often count for nothing at all in the example considered, because of such incidental circumstances as the vertical division of one rectangle into four equal parts, while its 'analogous' rectangle may happen to be effectively disguised by horizontal division into two unequal parts.

Yet making due allowance for the aberrations of human frailty when the blood is up in pursuit of a coy and elusive theory, there is a substantial residue of evidence as to the persistence of analogous rectangles in many notable buildings. The inference that the persistence was intentional in every case is not so clear. The value of such persistence, and the value of the proportions concerned, will be dealt with more fully in the next chapter.

6. *The Canons*

The science of an earlier day, fully cognizant of the numerical relations which explain the difference between notes and noises, but as yet unable to comprehend the facts of vision, left the investigator of form free to seek explanations of a fantastic kind, with the result that the arts of design, and more particularly architecture, became cumbered with a body of precept (one cannot call it theory) based on the supposed virtues of perfect numbers.

Canons for the proportions of the several parts of the 'perfect' human figure, as if such a modulized standardization could have any meaning or application without respect to racial type, age, athletic proclivities or the work a man did, had been established by Greek sculptors, as has been noted, and have been toyed with ever since. The exercises in human mensuration carried on among the athletes of Harvard, by the late Professor Sargent, show at once how slowly superstition dies; and, by the agglomerate result achieved—a creature intentionally athletic, but almost hermaphrodite which could obviously excel in no athletic diversion—how futile it is to mistake a convenient geometric method of setting out an average human figure of Mediterranean stock for a basis of idealization. Girard Thibaust's (d. 1629) Mysterious Circle for the inculcation of infallible footwork for duellists, based upon a figure with arm upraised as diameter and a sword, measuring, from point to cross bar, the same as the radius so established, shows how great a force this love of occult geometrical formulae for the elucidation of practical matters had become in the period of the later renaissance. And this was the period in which the architectural traditions, which have persisted most tenaciously up to the present day, were fully established. The redoubtable fencing master's pupils were not among the fittest who survive, however.

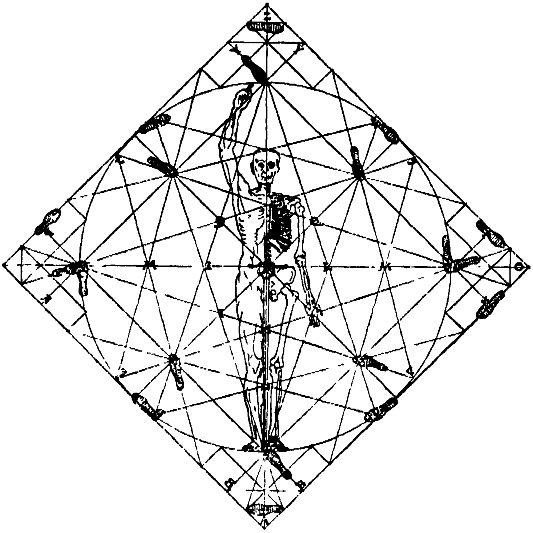

FIG. 44. The Mysterious Circle of Girard Thibaust, the famous fencing master.

The monstrous efforts of Batty Langley, of Gothic Revival fame, to modulize a set of 'orders' of medieval architecture, were in the end as futile as Thibaust's tactics for swordsmen, but they show how the wind was blowing through the whiskers on flushed architectural cheeks, in his time. But Langley knew perfectly well what he was doing; he was following Vitruvius faithfully in principle and with at least equal ability. But Vitruvian lore survives by the accident of his having lived and written in an interesting period, and the further accident of the survival of his writings in medieval libraries, while Langley was seen through by his intelligent scholarly contemporaries almost at once.

Now your exponent of proportional relations in Classic architecture has even sought to account for the subtle quality of the feeling with which a particular temple affects both him and you (though the feeling he derives from it is possibly quite different from yours) by attributing the result to certain ratios of length to height persisting in the various parts, great or small, throughout the fabric. Nothing is easier than to discover non-existent relations, and the inquirer should also be ever on his guard against attributing to intention what is merely accidental. We must seek to distinguish between intentions, which may be a matter of cultural and technical interest, and results which are by no means dependent on such intentions. If the proportionists would forgo the temptation to force the evidence, they might throw much light on the methods of composition current in classic times. Such methods are of immense archaeological interest, but their applicability to modern practice is here denied.

7. *Summary*

A brief summary of the foregoing remarks may here be made before passing on to a structural analysis of the forms which the theories were designed to support and propagate. The Greek architect's position has been considered with respect to the incentives and limitations of his efforts. We see him devoid of the stimulus, either of intricate planning, or of rapid evolution in structure, and wholly absorbed in achieving consistency of expression in connexion with what he possibly recognized to be a far from rational system of design.

Next we find Vitruvius taking it upon himself to carry standardization a long step farther than any Greek had ever ventured to do; and doing it with such dogmatic good faith that he carried conviction to a later age.

Then we have the spectacle, in fifteenth-century Italy, of men of brilliant attainment and superficial scholarship, who ought to have known better, sinning against the light in their pose of respect for the authority of Vitruvius, whenever the question of proportion is broached. These free-minded creators of a great tradition were perhaps camouflaging their own daring originality under the 'rules of art' for the appeasement of pedantic clients when they forged the chain of academic bondage.

After them came the exponents of the grand manner, sign and symbol of centralization with all that that connotes of exaggerated opportunities and cramped careers. To these, a cut-and-dried system of design was not merely as the breath of their nostrils, but an essential instrument of service. They were above all things for proportion in architecture; they were uninformed of its very nature and the secret of its potency, yet they built very splendidly and with great assurance.

And last there come the archaeologists of the three generations of the immediate past, and these have sought among the ruins of Greece and of Rome with circles and squares and other figures; and they have found some analogies of form and invented others. Their researches were vitiated from the start by a knowledge of the very fragmentary writings of the Greeks, of the *obiter dicta* of Vitruvius, of the comments thereon by Serlio, and of the discussions of the French academicians. In the light of this doubtful knowledge they sought, even in the nineteenth century, for mysteries and miracles.

And no one who has dabbled in the matter has yet said wherein the virtue lay of all this love of modules and parts and golden sections, though many have averred much good in them because Vitruvius said so.

Are we then to say: let the height and thickness of columns and piers and lintels and openings and bands and projections be in simple ratios of whole numbers, so that the eye may realize and delight in them as such? Why so? The optical apparatus does not concern itself with such things or take satisfaction therein.

Are we to say: design your structure so that it be pervaded with the double square, set upright and set horizontally, or else let the golden section govern the areas of your voids and solids because the eye and mind respond to the double square and delight in the golden section? But the optical apparatus does no such thing.

Or, are we to admit that the eye does not record numerical ratios as such, nor the mind take satisfaction therefrom, nor yet delight in the double square and the golden section; and yet aver that a mysterious quality of things seen called beauty can be achieved through hidden and imperceptible numerical relations subsisting between part and part? If we do that, are we on surer ground? Outside the realm of sorcery surely we are not.

Nor is there either sense or logic in invoking precedent by saying: because once in a Parthenon of sunlit marble, therefore now in a National Gallery of grey sandstone exposed to 'the gloom which saddens heaven and earth', this and that relation of parts should prevail.

We are then faced with the questions: do these numerical relations among parts afford any satisfaction? Do rectangles, having certain relation of length to breadth, affect us in a way which rectangles of other ratios do not? The answer in both cases is very positively in the negative. Then we may ask: do certain proportional relations of part to part and prescribed proportions of rectangular areas (which cannot be even approximately appraised by the eye without the intervention of dividers and a drawing-board) in some indirect physical or psycho-physical or metaphysical way, convince the beholder that he is in the presence of a work of art; that the thing before him is coherently eloquent; that it inspires him with emotion? No, very certainly not.

8. *Structural Analysis of Orders*

What is happening in those systems of trabeate construction first elaborated by the Greeks and handed down to us with the blessings of Vitruvius, Serlio, L'Académie des Architectes du Rio, and the assurance of many professors of architecture in recent times, that they embody or exemplify the rules of proportion? What is happening structurally; what is taking place? The answer depends on the scale on which one employs the system. If one is going to use orders, and there is much to be said for the practice, it is just as well to know what one is doing.

Assume the use of sound marble, which will not crush at a pressure of less than 10,000 pounds to the square inch, and divide this by 10 for safety. Consider a series of loads borne by a series of 10-ft. columns, the first load including the weight of the column, being 56·5 tons, which on a column of 12 in. diameter at the base would produce a compression stress of 1,000 pounds per square inch of cross-section; the second, third, and so on up to the *n*th load being twice, three times up to *n* times as much as the first. Let each of these 10-ft. columns be conventionally designed with a taper parallel to that used in the first of the series, but let the area of the base in each case be in strict proportion to the load. Then each column is stressed to 1,000 pounds per square inch at the base. Structural proportion is then manifested; formal proportion has been abandoned.

The next point to consider is the limits within which such a structural device as a classic order of fixed proportion can be used. Take any fragment of an order; say a pair of columns and the entablature they carry. If we double the scale of the order, then the height of the column, the diameter of the column, and the depth and width of the entablature are all increased in the proportion 1 to 2, and the formal proportional relations remain analogous. But the sectional area of the column is now increased in the ratio 1 to 4, and the weight of the entablature borne by the column is now increased in the ratio 1 to 8.

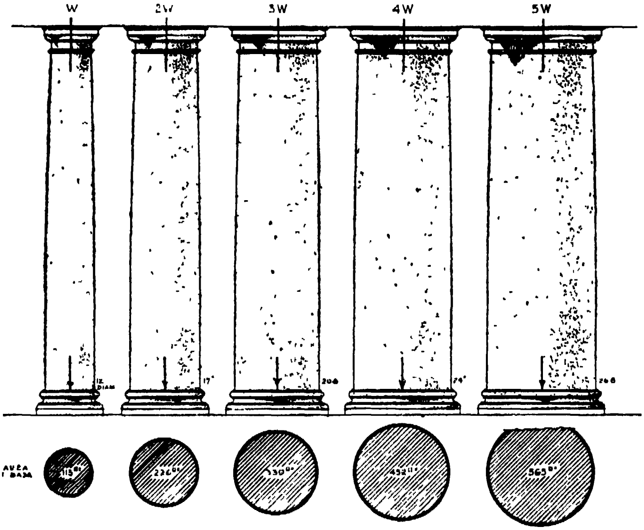

FIG. 45. Conventional columns, modified as to area only, in proportion to a series of increasing loads.

Suppose a normal order with the column 10 ft. high, and having a neck diameter of 12 in.; the entablature borne by the column might then weigh about 1,700 pounds, giving a stress of 15 pounds per square inch at the neck of the column. In the case of a similar order with the columns 60 ft. high, the weight of the entablature would be 333,200 pounds, giving a stress of nearly 82 pounds per square inch at the neck. A much greater load and a much weaker material might be involved in any given case.

Next let us consider the case of equal loads represented by a story of fenestrated wall built over an entablature borne in the one

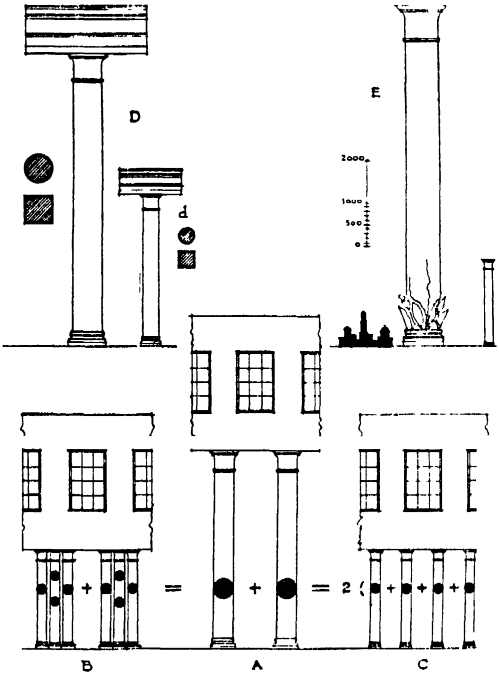

FIG. 46. A, B, C show a constant load carried on orders differing in scale in the ratio 1 : 2.

D. Column, entablature, and plans of shafts for two orders in ratio 1 : 2.

E. Failure of a marble monolithic column to bear its own weight; note the scale of feet.

case by 2 standardized columns 20 ft. high, in the other case by 4 standardized columns 10 ft. high, the distance apart of the columns being constant with respect to the diameter sizes. The combined areas of the 2 columns, in the case of the larger ones, is 904 square inches; and the combined areas of the 4, in the case of the smaller ones, is 452 square inches. It would take 8, not 4, of the smaller columns to equal the 2 larger ones in area. It is thus made clear that where the load is not modified by increasing the scale of an order—that is to say, where the load is constant—the larger the order the less the stress in the necks of the columns; on doubling the scale the neck areas increase fourfold.

So much for the conventional order as a structural device for bearing loads, great and small. What could be less scientific than an Academic practice which imposes approximately constant proportion of members, without reference to dimensions or materials?

The great Roman architects of the early Empire seem to have ignored Vitruvian precept and had few illusions on the structural use of columns. They treated the orders with an insincerity so frank, that confusion of thought was impossible. Their refusal to take them seriously represents scientific advance rather than architectural depravity.

Perhaps it is safest to regard the Classic Orders as metrical formulae, somewhat analogous in their uses to those found in verse. Other architectural systems, than those evolved in Greece and Rome, are no less well endowed with metres of their own. Perhaps one is only the victim of historical knowledge and associations, when finding in the favourite formulae of Gothic art something akin to the Gregorian chant, or in the ancient orders of architecture cadences reminiscent of those that rumble thunderously through the hexameters. But in any case, formula as well as form can be generated by the theme; otherwise both are meaningless.

The reader is now in a position to realize that the orders of architecture—columns, caps, bases, friezes, and all—whatever else may be their uses, become ludicrous, from the structural point of view, outside a strictly limited range of scale.

9. *The Appreciation of Proportion*

In the light of what has been said, consider please what the fellow who writes or talks of made things would have us to understand when he attributes to them such qualities as 'delicate proportions' or 'gigantic proportions' or even 'chaste', 'good', or 'bad proportions'. Usually, in the recondite effusions of criticism and appreciation, the phrase 'delicate proportions' just means delicate or refined; and when proportions are described as 'gigantic' it is simply meant that the object in which the proportions subsist is big or very big of its kind. By 'good proportions' in a structure, the critic usually means that the structure is composed of members whose forms are quite familiar to him, thus conforming to the residue of his past experience on the matter in hand. By 'bad proportions' he indicates that there is something irregular or unexpected about the form of the object which he does not understand; in which case the blame may be his own, or possibly the designer may be at fault for the use of phrases of form incomprehensible to his public. Just what is meant by 'chaste proportions' it is difficult to imagine, unless slender construction is thereby compared with virginal leanness, or the scragginess of the old maid of caricature.

It is a commonplace that architects of ripe experience incline to the view that nothing matters so much as proportion, that is to say, they come to recognize that the relation between the width and height of one window with regard to the width and height of another window, possibly of different size, may be a medium of emotional expression. One may be sure that proportion is a vital matter in design, even if it has been the subject of misconception amounting to superstition time out of mind.

The mystery-mongers and charlatans, who have obscured the issues with regard to proportion in architecture throughout the centuries, have been faithfully dealt with. An attempt has been made to explain how their misconceptions came about. In the light of more recent knowledge of the mechanism of perception, it should be possible to arrive at an understanding of proportion without invoking the occult.

X

PROPORTION IN DESIGN

1. *Geometrical Proportion*

THE evolution of proportional dogma has been traced. If all the threads in the tangled skein have not been wound up, the ends of the main threads, the three longest of which may be labelled as embryonic construction, residues of past experience, and blind respect for authority, have been identified. Incidentally, the inconsistencies that come about as between formally constant proportion and structurally functional proportion, when scale is changed, have been made clear.

Geometric proportion, as such, remains to be considered; also the interest people in general, and architects in particular, take in the proportions of buildings, and of the parts of buildings. The question of how this interest arises, likewise demands attention.

Two triangles are said to be 'similar', no matter what the difference in their areas, when the three angles of the one are equal to the three angles of the other, 'each to each', as the old school-books say. In such triangles the sides about equal angles are in proportion. If *ABC* are the sides of a large triangle and *abc* the respective sides of a small similar triangle, the angles between *A* and *B*, and *a* and *b* are the same, and the relation of these sides may be expressed thus:

$$\frac{A}{a} = \frac{B}{b}, \text{ or } \frac{A}{B} = \frac{a}{b}, \text{ or } A : B :: a : b, \text{ or } a : A :: b : B, \text{ \&c.}$$

It is not the lengths of the respective lines under consideration but the ratios of the lengths of pairs, or groups, of lines with which proportion is concerned. These ratios may always be expressed algebraically and usually arithmetically. Any rectangular figure can of course be subdivided into component triangles for proportional analysis by the simple process of joining opposite corners.

It follows that parallelograms, of any areas, are similar if they are such that when diagonals are drawn connecting the acute or obtuse angles (or in the case of rectangles, any opposite angles), such diagonals make equal angles with the corresponding sides of the parallelograms. It follows, also, that in the case of rectangles which are similar, and similarly placed (e.g. long or short sides up), no matter what their size, the diagonals will be parallel. All circles are similar in the above sense, no matter what their areas: all sectors are similar if the radii involved form equal angles at the centres, and all segments are similar if they are such that the chords and the tangents, at the point where the chord and circumference meet,

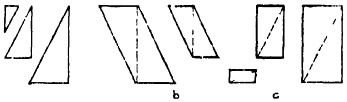

FIG. 47.

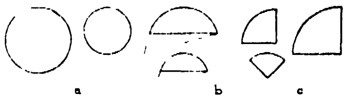

FIG. 48.

FIG. 47. Proportionate rectilinear figures.

FIG. 48. Proportionate sectors and segments.

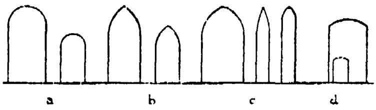

FIG. 49.

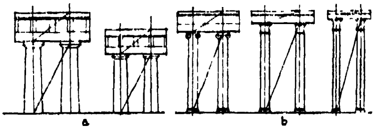

FIG. 50.

FIG. 49. Proportionate arches, *a*, *b*, *d*. Disproportionate arches, *c*.

FIG. 50. Proportionate orders, *a*, and disproportionate orders, *b*.

make equal angles. It is not the areas of figures but the shapes that are under consideration. And so with other figures, regular or irregular. It will be observed that to ascertain whether two quadrilateral figures are 'similar', in this sense of having the same proportions, it is only necessary to place them in the same relation to a line, and then consider whether the diagonals are parallel, in which case the proportions of the figures are constant.

Certain dimensional units such as feet and metres, and certain proportional relations, are commonly used in the setting out of buildings from motives of technical convenience, and these may be described with advantage before going farther.

The square 1 to 1, the double square 1 to 2, and such relations for the sides of rectangles as can be expressed as 3 to 4, 3 to 7, 4 to 10, and so on, are the simplest.

The relation between the side of a square and the diagonal is one of frequent occurrence because it is so easy to set out, however difficult to calculate. This relation, if the square is unity, may be algebraically expressed as follows:

$$\frac{\text{side of square}}{\text{diagonal of square}} = \frac{1}{\sqrt{2}}.$$

A second pair of dimensions in the same ratio may be found by taking the diagonal of this first square to the diagonal of the square set upon it. A series of dimensions in continuous proportion can be found by this construction, and starting with unity, the series will be as follows:

$$1 : \sqrt{2} : \sqrt{4} : \sqrt{8} : \sqrt{16}, \text{\&c.}$$

Another commonly used and time-honoured proportion is known as the 'Golden Section'. In this case the lesser dimension is to the greater as the greater is to the sum, or

$$\frac{a}{b} = \frac{b}{a+b} \text{ algebraically.}$$

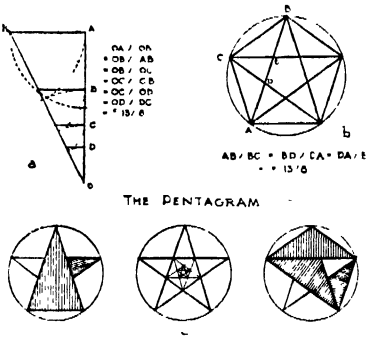

FIG. 51. The Golden Section and the Pentagram.

It will be observed that again a series of dimensions in continuous proportions may be found by an easy geometrical construction involving the pentagon. Such a series as this may be continued upwards or downwards in value. For instance, starting with 100 for convenience as the sum of two dimensions in 'extreme and mean ratio' (the modern name for the Golden Section) we get a series approximately as follows:

$$\frac{61{\cdot}805}{100{\cdot}000} = \frac{38{\cdot}198}{61{\cdot}805} = \frac{23{\cdot}607}{38{\cdot}198} = \frac{14{\cdot}501}{23{\cdot}607} = \frac{9{\cdot}017}{14{\cdot}501} = \frac{5{\cdot}574}{9{\cdot}017}, \text{\&c.}$$

It will be well for a moment, before going farther, to consider the relation of the purely linear proportions dealt with so far, to the areas of figures and the contents of solids. It is only necessary to recall that two squares, the one on a 2-ft. base, and the other on a 3-ft. base, vary as to their sides in the ratio 2 : 3, as to their areas in the ratio 4 : 9, and as to their cubes in the ratio 8 : 27. Between these ratios there is a relation but it is not one of constant proportion such as that expressed by the numerals:

$$2 : 3 :: 4 : 6 :: 8 : 12 :: 16 : 24.$$

Now the design of structural members in relation to their functions is largely a matter of proportioning areas to stresses, and the calculation of loads by cubic weight. This is a fundamental part of design—the discovery of form.

At Stonehenge a pair of upright stones carry a third, dividing its weight equally between them. If the two standing stones are the same in cross-section, they are equally stressed; their stresses are proportionate to their loads as between themselves.

The proportioning of areas to loads and stresses of various kinds is another matter. That is done by considering the stress the material will bear without failing, and allowing a factor of safety to allow for invisible defects, or faulty workmanship. The factor of safety may be one-sixth, or one-tenth, or some other fraction of the stress the material can stand. In designing the spars and rigging of a racing yacht, a very small factor of safety, sometimes none at all, is allowed. In structures, a member is well proportioned when its ultimate strength and a judiciously determined factor of safety are both taken into consideration with a knowledge of what the stress is.

When similar members under similar stresses have similar dimensions, they are proportionately stressed, and when dissimilar members under dissimilar stresses are stressed to the same extent they are again proportionately stressed, and necessarily differently dimensioned if the material be the same. All the members of a structure may be proportionate in this sense. Consistency is the ideal. The different parts of a member may be differently stressed, as in the case of a cantilever with a weight on the end, or a cylindrical column with a weight on the top, and this weight plus its own weight to support at the base. In such cases equal stress may be provided for by varying the depth of the cantilever from point to point, or the diameter of the column from point to point. This was the underlying idea in giving a taper to the stone column. The wood prototypes of these columns tapered the other way, probably because they were driven into the ground; less cutting was thus required in making the point.

It was seen that structural devices, such as columns carrying entablatures, which are similar in form or have the same proportions, but which differ in scale, are not equally stressed. For example, the columns of the peristyle of the Parthenon take about double the load per square inch that those in the wings of the Propylaea do. Neither is overstressed, but the formal proportions in both orders are similar; in the greater order the column has about half the factor of safety of that in the lesser order; that is to say the functional proportions vary.

So simple an element as an arcade of four bays, with a fixed height and pitch for the piers, occurring in a wall of given thickness and height, would differ considerably, if designed for Caen stone and for granite piers with the same factor of safety. Material as well as size has its effect on form.

2. *The Appreciation of Building*

What are the circumstances under which building, regarded as an art, makes its appeal? On the stage the action which accompanies the spoken word goes on till the fall of the curtain. A picture is sought out, looked at, and left. Few can really live with a picture, and few pictures continue to be really lived with, for, with familiarity the interest wanes. The wandering tourist never gets what matters most out of the monuments he inspects so conscientiously. Even if the wanderer is a student of architecture, the mixed bag that he gets on visiting a city, new to him, is poor shooting and affords an indigestible meal. Architecture is best absorbed frequentatively and within the fabric of the daily life. It is only the buildings we pass often, the buildings we see from our work-room windows, and the buildings we use for habitation, work, play, and worship, in which we can take a full delight, or whose existence we can actively deplore. Of other buildings elsewhere we may say that we do, or do not, know that they exist; and in the former case may assume that those who use and see them often may take delight in them, but we cannot know the delight they afford. Of our familiar buildings we may say that we know them, as we know our friends, with all their faults perhaps, and that their façades have habitual expressions even as the faces of our friends have—sad, stern, serious, serene, smiling in the teeth of fate, or just happily gay. And some buildings that we cannot make our friends are dull, or inscrutable, or glum, or just stupid to us.

3. *Recurrent Forms*

Taste is largely rooted in experience and affects both the artist and those who contemplate his works. In the case of the artist, experience of his own work, or rather of his own working, engenders habit; and it often comes about that artists tend to repeat themselves, using certain analogies of form recurrently throughout their designs, sometimes illogically. Thus the Greek designers of the Doric tradition, working for centuries with an elementary, artificial, and restricted system of construction, repeated the section of the portico in the frieze and cornice and again in the upper member of the cornice. This has some virtue, but it is idle to suppose that it was done on purpose; and its virtue certainly does not depend on the numerical relation between the vertical element and the horizontal element. What virtue there is, is of a negative kind. No new form obtrudes on the attention. The characteristic form is echoed. The thing has a sort of law of its being, as some trees have, whose usual profile is echoed in the form of the leaf.

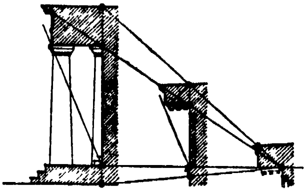
FIG. 52. An interesting case of analogy of form elucidated by Prof. August Thiersch, *Handbuch der Architectur*, ed. 1904, iv, p. 43.

The miniature decorative architecture which adorns the actual structural architecture of fourteenth-century building in England is another case in point. That this was done on purpose and by rule in the case of the Greek, and out of the exuberance of his heart by the Goth, has never been proved, though suggested by writers on each period. But it must be borne in mind that the men who conduct researches on Greek or on Gothic art are cast in more fundamentally different moulds than the artists of either era. The thing was probably unconscious in either case. Perhaps it had something in the nature of an exhausted invention in both. In any case it was sound practice and imparts to many a building a quasi-organic unity. Much the same sort of thing is to be noted in many other kinds of architecture. When consciously applied, as it no doubt has been by the recondite architects of sophisticated eras, recurring analogies of form at varied scales, but in constant proportion, afford a potent artifice for unification.

And so it is with our double squares and that favourite ratio of the side of a square to the diagonal, and with the Golden Section. There is no virtue in these relations, or in integral numerical relations as such, and it is the purest superstition to believe otherwise. Yet many a building possesses a dignity, a serenity, a sense of stability, or some other distinctive character, because of the habit of its designer in the matter of the Golden Section or the double square. But any other ratios natural to the structure which might recur dominantly would have served equally well. It is not the ratio but the fact of its recurrence that matters. Without recurrence there can be no rhythm; and rhythm provokes mood.

It has already been shown how two similar rectangles can be made to appear very different by dividing up the one horizontally and the other vertically. Not only is the eye quite unable to appreciate slight differences of ratio in rectangles of about equal area, occurring in different stories of a building, say the one of 1 to 3 and the other 2 to 7, but similar rectangles occurring in different parts of a building usually do look dissimilar owing to minor subdivision, or the exaggeration of character due to contrasting forms in their proximity. When foreshortening due to height and the diminutions and distortions of other perspective effects—to say nothing of optical illusions—are taken into consideration, it will readily be realized that in a building, even of the simplest description, things are rarely what they seem in the matter of dimensional relations.

The student who measures and then sets out a drawing of an existing building experiences a series of valuable surprises, particularly if any considerable dimensions of height are involved. He realizes, in a way he never could by drawing the thing out to a different scale from a plate in a book, that architecture is a trade full of tricks. This realization lays him open to the wiles of the facile astrologers who prate of perfect numbers and the secrets of proportion. Proportion is more difficult to master, but far less mysterious than the necromancers would have us believe.

When dealing with composition, there will be something to say of the artistic use of proportion in contrast, in analogy, and in climax.

Buildings make their proper appeal when their precincts are frequented. They are designed to be seen in ever-changing perspective, and in ever-changing lights. Under these conditions there is a premium on general simplicity. They are, moreover, felt as masses, not as the shells they really are. The complication of subordinate detail may be infinite in a thousand ways, but it is a condition of effect that the detail should reinforce the character of the whole. The devices of proportion can find abundant employment in this intensification of character. The building that lacks character, whatever interest of prettiness, or charm, it may possess to attract the attention of the vagrant tourist, does not grip the spirit of those who know it as part of their daily environment.

4. *Formal and Functional Proportion*

How have all these misconceptions arisen? There are two quite distinct senses in which the word function may be used in reference to a design, whether executed or not. First there is function, meaning the use of the thing, its purpose or purposes: in the case of a building the use may be habitational, or ceremonial, and so on, and the several rooms, or parts, will have their specialized functions or uses, such as entertainment or ritual. Secondly there is function dependent on structural consideration arising from material and technique: in the case of a building, vertical support in the columns, piers, and walls, and horizontal support in the beams, arches, trusses, and other members.

Now those who frequent buildings are very good judges of proportion with respect to function in the first sense. They readily realize the relation of length, breadth, and height to purpose in the case of a dining-room or a church. They are the best judges of good proportion in such matters. They are quite properly indifferent to ratios. The height and breadth might be equal and the length double the breadth, but this would and could make no difference to the judgement. Would make no difference; because the belief that it is a privilege to be allowed to stand on the floor of a double cube room is not widespread and when it occurs rests on illusion and bad authority. Could make no difference; because even if the frequenter were an expert juggler in proportions (as every architect should be) he could not without measuring rod ascertain that he was indeed in a double cube room.

But where structural members are in question and the function relates to structural use as distinct from general purpose, the man in the street is not a good judge of proportion. He assumes equal, or at least adequate stability in anything with walls and a roof that is not in ruins. In such matters the architect bases his judgement very largely on precedent, and only interests himself in factors of safety and stresses and loads where the structure is abnormal in type or in precarious condition. The engineer, on the other hand, distrusts his eyes and prefers his slide-rule and some ascertained facts before he passes any judgement at all. Structural inconsistencies of the grossest kind are thus readily acquiesced in by the general public, architects, and engineers alike. In a structure whose frame may have been calculated with the greatest precision and consistency, one often finds colonnades in which the factor of safety may be anything from three to three thousand. The probability in such a case is that the colonnade is not conceived as part of the structure, but as a piece of rhetoric which, if bound at all, is only bound by formal as distinct from functional proportion.

We all count it to him for grace when a finance minister mitigates his unpalatable facts with the flowers of rhetoric, so long as he does not obscure them; and we welcome the homely similes with which the astronomers of our day delight to make their popular expositions of unthinkable voids and unimaginable masses. So, in design, some poetic licence must be accorded to the designer when he begins to concern himself not only with the thing but with how he feels and wants other people to feel about it. This is where architecture begins; or, if you like, where pure design ends.

5. *Scale and Proportion*

For the realization of the actual size of objects, great and small—always an important element of effect—there are two distinct methods open to the designer. These may be combined intentionally. They must inevitably be mixed to some degree. But there is choice as to which shall dominate. The one is based on proportion, the subject now before us; the other on scale, which has been dealt with in a preceding chapter. The classic Mediterranean tradition in design relies very markedly on consistency of formal proportion, while the Gothic, or northern medieval tradition, relies chiefly on consistency of scale. The Greek of a given place and time would thus, as has been seen, use columns of approximately the same shape, whether they were 35 ft. or 17 ft. in height, while the Goth would use one or two lights to form a small window and eight or nine lights, each about the same size as in the small window, to form a big window. In the one case you require the presence of a fixed unit, say a man, to enable you to realize the size of the colonnade; in the other, the unit of measurement pervades the structural element in question, or even the whole fabric.

But, in stressing the principle of constant proportion in classic architecture, it is often forgotten that Greek and Roman builders, if a little blind to structure-function, were at least as sensitive to use-function as the builders of sailing ships in recent times. A small ship may have one or two masts, a big ship three or four, and a ship of the kind developed at the end of the last century, too big to live long, might have five or six. So with the temples. The small ones had fewer parts. One could not get in or out of the temple of Nike Apteros if it had eight columns on the front of it, and one could not work a 40-ft. boat with three masts and top-gallant sails. There are practical size limits to formality.

6. *Conventional Proportion*

It must not be inferred from anything said above that the proportioning of structural elements without close reference to engineering consistency is either aesthetically or ethically reprehensible, although it may be practically and economically reprehensible. But the designer should at least know what he is doing and be in a position to realize wherein his building, or his chair, is merely expressing its own essential structural facts and wherein it is expressive of his feelings about its structure and its use. Inherent functional proportion should be clearly distinguished, in the mind of the designer at least, from arbitrary, conventional, or intentional proportion.

Design in all purity is manifest in nature. With an approximation to purity it is the aim and object of the engineer and the constructor. With artistic modification superadded it is the achievement of the artist. But, even when building is the matter in hand, this increment of artistry does not necessarily involve recourse to architecture; although usually it does. For what is architecture but a systematic code, made up of forms consecrated by the accidents of tradition. So when recourse is had to this code it is well to remember that it is essentially systematic—that it has a grammar of its own—that its standards of pronunciation may be illogical like those of cultured speech—but that rhythm in form, as in diction, is dependent on just that kind of standardization and convention with which Sir Philip Sidney and the early Elizabethans so wisely concerned themselves.

It has been more than hinted that those who explore the secret proportional relations in the structural elements of ancient buildings often delude themselves and others. Now it is boldly asseverated that design without proportion is a salt without savour, and architecture without proportional standards is unthinkable. How does one reconcile these attitudes?

7. *The Proportional Fallacy*

The claim that this, or that, or these several proportional relations, such as the 2 to 1, the 1 to √2, or the Golden Section, has an aesthetic or hedonic value is readily met by recalling that the eye, as an organ of sense, is indifferent to forms and that the mental processes of judgement which the eye stimulates require much education to distinguish rectangles having such relations and can, even then, be very easily deceived. There can be no hedonic satisfaction, direct or indirect, in such exercises.

Consider the circumstances under which rectangular forms occurring in designed objects—openings in walls for example—are seen or apprehended by eye and mind working in conjunction. The answer is: rarely, if ever, without misleading foreshortenings (horizontal, or vertical, or both) except when such forms are translated into mechanical drawings of small scale which are then held at right angles to the line of regard at a distance of from 10 in. to 6 ft. Recondite numerical relations between the width and height of rectangles can have no intrinsic values, optical or mental.

And so it is with the dotted circles struck to embrace the angles of pediments within a quadrant, and with all other setting-out lines, actual, or imaginary, which the proportionist delights to discover. When actual, his discoveries are merely the designer's original setting-out lines and geometric constructions for practical use and convenience. If an opening, still more if a series of openings, about twice as high as wide is required, it is easiest to set it out exactly so. If the foot, or the cubit, or the metre, be the unit of measurement, exact numbers are in order for convenience and need no further explanation. The ratio, side of a square to its diagonal, is a peculiarly handy one requiring one measurement and the rest instrument work. The Golden Section as a construction for setting out is not so practical. The construction has in itself something of the mysterious. The great popularity of this proportional relation could hardly have been brought about until the error of mistaking means for ends in the case of setting-out lines had become general. Possibly the undertaking to instruct one's apprentice in the 'art, trade, science, and mystery' one practised gave to the setting-out lines (which the apprentice had the job of rubbing out) an air of mystic value. The thing shown on the finished drawing was calculated: the calculation was a little mysterious: beauty, the fundamental problem of the older aesthetic, was also mysterious: the one mystery explained the other: the Golden Section was a secret of beauty! And in due course another apprentice was inoculated.

Nothing further need be said with respect to a good, better, or best in abstract proportional relations. It can never be what the proportions are that matters. It is in how they can be used by a great artist in design that their interest for the student lies. It is, of course, pre-eminently in architecture that this happens.

8. *Conclusion*

An example may be helpful at this point. There is a certain quality about the Palazzo Farnese and there is a proportional secret. Whether one appreciates the quality or not, one may be quite sure that the secret and the quality have a good deal to do with each other. The proportional secret that matters is not the fact that the dominant ratio is 2 to 1, which it is, but the much more interesting fact that one ratio dominates nearly everything. This incidentally leads to several remarkable inconsistencies in the composition, but let that pass. The prevalence is what matters, not the ratio selected; the prevalence, even if, as in this case, it is carried too far.

Repetition of similar minor elements—a row of windows for example, or a series of bays—is inherent in the solution of most problems of design for buildings. When the fabric of a structure becomes thus pervaded with a dominant repeating, functionally and structurally generated, proportional ratio, it matters not a whit what that ratio may be; but it does matter that other elements, in which proportion is at all involved, should be dimensionally related to the dominant, characteristic, recurring ratio. This relation need not be one of similarity. The rhythm of the composition may depend on the use of the dominant and one or more subordinate proportional ratios; or on a set of ratios distinctly different; or on a pair of ratios in mild, or acute, contrast.

There can be no such thing as composition, or orderly arrangement of a façade (which is usually an affair of rectangles) if it has all its structural elements set out haphazard with respect to spacing and placing. If irregularity is an essential characteristic of the thing, as it may often justifiably be when the functions of its several parts demand such recognition, the proportional unity of the whole may yet be maintained by adroit subdivision of these proportionally heterogeneous elements. The framing of windows into lights for the sashes and the subdivision of the sashes into panes of a fixed, recurring ratio (and often of a fixed actual dimension) both offer opportunities for the exercise of this device. Much good architecture is indeed dependent on nothing else than this for its claim to a place in the realm of art.

One may be tempted to say that proportion is the thing that matters most in architecture, and one will not be far wrong; but it is perhaps safer to say that the interrelation of scale and proportion is the thing that makes composition possible. Whether the object be as simple as the Maison Carrée at Nîmes or as complex as Compton Wynyates, it is on scheme with respect to these two matters that it must depend for its unity and its character. Without unity the thing dissolves into two or more things and without character it becomes inane.

XI

CORRECTIONS AND REFINEMENTS

1. *Introductory*

IN writing of proportion it was found necessary to sweep away some of the mystic shroud enfolding the subject. Considering what physics, that most exact of sciences, has had to jettison in the last generation, it is astonishing that, where the visual arts are concerned, those pseudo-sciences, on which their practice is so often based, should have so long withstood the disintegrating effects of time and progress. In the case of proportion a whole chapter had to be expended on demolition.

With respect to corrections and refinements some demolition is also necessary, but in a lesser degree. In this matter, so technically subtle, the theories derived from ancient practice have remained comparatively barren of practical application. A host of designers, who have accepted without question what Vitruvius, or Scamozzi, or Pennethorne, or Penrose, or Goodyear had to say, have had little opportunity to put the matter to the test in their own work. Corrections and refinements are expensive in execution. Mediterranean sunshine and Pentellic marble might justify what could never be compassed in the pearl grey light of London and with Portland stone.

So it comes about that generation after generation of students read, apparently without amazement, that 'long lines' in architecture 'if built straight in reality would appear to sag, or drop, in the middle of their length' and slight convexity is offered as the cure. After the decay of the Greek tradition men have had to be content with fair work and square work, for the most part, and to confine their efforts in refinements to rules of thumb for the entasis of circular columns with classic capitals. For the most part, one may say; yet when Gothic art was at its summit, and particularly in England, certain refinements and corrections were general whenever they could be afforded.

Nineteenth-century discoveries of Greek practice in corrections and refinements might have led to a more practical interest in the matter, had they been accompanied by a more serious effort to relate them to the optical facts. But it must be remembered that it is only recently that most of the illusions have been even plausibly accounted for and defined. Scientific interest in the illusions was undoubtedly stimulated by the minute investigation of the corrections and refinements practised so long ago.

To-day the illusions are defined and in some cases explained. In others, there are theoretical explanations and controversial efforts to bridge the gaps of knowledge. In the chapter on The Nature of Form Vision the commonly noticeable illusions were described without accounting for them. These illusions are not diseases: their cure does not demand a knowledge of their causes, but of themselves. Corrections are an empirical business.

By a correction is meant an intentional deviation from the fair and square, resorted to with the object of making the fair-and-square-made thing look fair and square. When one speaks of a refinement one means carrying the process beyond mere correction (which is usually only effective from a fixed point of view) and making the fact of there being a correction quite obvious and, so to speak, glorying in it. That is to say, the correction becomes a subject of artistic expression.

It was remarked above that, except in the matter of columns of certain kinds, refinements are rarely practised to-day: yet most serious designers are acutely aware of unpleasant effects in their own work which, they feel, could have been mitigated by resort to corrections. By unpleasant effects one means those appearances of straight, vertical, and horizontal lines in piers, quoins, beams, and particularly in the upper elements of buildings, which feign a horrid instability; and in the case of the last-mentioned do in appearance, though not in fact, seem to overhang. Now without resorting to corrections at all, but simply by avoiding the use of certain time-honoured forms, some of these difficulties can be prevented, or greatly mitigated.

2. *Historic Development*

Before passing on to the consideration of the known means for overcoming the commoner illusions in whole, or in part, a note on the development of thought on the subject may be of interest.

Greek architecture in general and the Doric order in particular, with its simplicity and great dependence on repetition, by its very nature invited optical illusions. So whenever they could afford it the Greeks attempted to deal with them and often succeeded very well. This empirical science was not fostered by the conditions under which the Romans did their building, although they appear to have been well aware of the Greek effort in this direction. Ictinus, the architect of the Parthenon, committed his practice to writing, but the book has been lost. Vitruvius may have read it or a subsequent restatement of the problems involved. His own contribution does not amount to more than a corroboration of the fact that the problem was recognized in the first century A.D. The Italians of the Renaissance give Vitruvius credit for knowing all about it, but Peruzzi, by far the most Greek-minded of all the Italians, does not appear to have either preached, or practised, the corrections.

The loss of Bramante's treatise, which probably reduced his own practice to a systematic basis, is much to be deplored, but there is no reason to suppose that he dealt with corrections; proportion would interest him more. The great exponents of versatility—Alberti, Michelangelo, and Leonardo da Vinci—do not seem to have been seriously exercised over the perverse behaviour of long straight lines in buildings; and it would hardly have occurred to any of them not to build a corner column plumb on its centre. Considering the exquisite delicacy of the architecture of the Italian renaissance it may seem odd that so little thought was given to the matter. But it may be suggested that the Italians succeeded, above all others, in producing an architecture which did not require correcting. So with Wren, Chambers, Perrault, and Gabriel; they were one and all adroit in not provoking distorting illusions in their work. Just how far this is attributable to good luck and how far to good management it is difficult to say, but the suggestion is hazarded that there was little or no luck about it.

Between 1832 and 1838 Pennethorne made a study of the Vitruvian canon of additions and diminutions on the spot, in Greece, the Erechtheion being the subject of his special study. It was not, however, till 1878 that his results were published. In 1847 Penrose made his researches on the corrections of the Parthenon and the Propylaea and his work has been the classic on the subject ever since.

The analytic study of Gothic architecture, which was the chief accomplishment of architectural scholarship in England from 1825 to 1900, was well advanced at the time of Penrose's studies in Athens. It appears, however, that it was not till some time after his researches that the measurers of English parish churches began to observe variations of form which could only be accounted for as correctional. It is interesting to note that two devoted students of English medieval art, G. F. Bodley and E. S. Prior, notwithstanding the diversity in the complexion of their thought, have both recognized that certain corrections were current practice in western Europe in the fourteenth century.

This aspect of the subject has been somewhat obscured by controversies centring on the enthusiastic championing of the case for medieval refinements by Mr. Goodyear of the Brooklyn Museum. Notwithstanding some loose thinking and imperfect observation, resulting in claims for intentional variation from the normal form where the variation could be explained on other grounds, it is well established that in thirteenth-century practice in western Europe to some extent, and in fourteenth-century practice more markedly, refinements and corrections of several kinds were quite general. The Black Death, which had such devastating effect on economic conditions, brought building to a standstill and this tradition died. In the later Gothic architecture there is no trace of corrections. But, having in consideration the character of this architecture—its brusqueness in England, its exuberance on the Continent—it is difficult to see that there could have been any great occasion or necessity for resort to corrections. Was it the knowledge of them or the need of them that had passed? Perhaps the knowledge with the need.

The advocacy for recognition of the facts as to corrections in Greek and Gothic art does not necessarily enlighten us as to how to direct our own talents in the matter. Observation of the buildings we know and frequent, with a knowledge of the several commoner illusions at the back of our minds, must be relied on in forming our judgements as to what is worth correcting and what is not and, most important of all, as to how not to provoke the need of corrections.

Some of the more usual corrections will now be described in the order in which the illusions they discount were touched upon in a former chapter.

3. *Top-heaviness*

The upper part of any figure appears larger in every way than the lower half. This is particularly noticeable in the case of tall cylinders and parallelepipeds. The effect is strong enough to overcome the vertical perspective diminution in the case of cylindrical columns 30 ft. high seen from 40 ft. away with five-sixths of the column above the eye. S's and 8's, as has been noted, are usually formed with the upper loops of less radius than the lower ones to discount this illusion. Classic columns without a taper look top-heavy on this account, and not, as is sometimes supposed, just because we are so well accustomed to see them tapered. Even a drawing of a colonnade set out in perspective with parallel vertical lines to indicate the outlines of the shafts will show this effect.

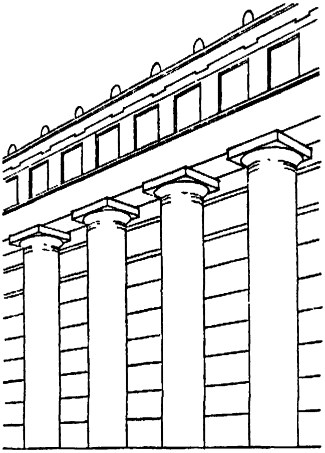

FIG. 53.

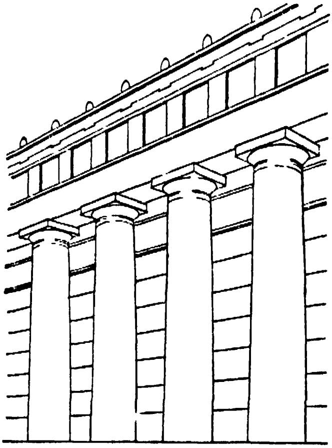

FIG. 54.

FIG. 53. The illusion of increased size in the upper portions of figures exemplified by a Doric colonnade with cylindrical drums.

FIG. 54. The same colonnade as in Fig. 53 with the columns tapered more than enough to neutralize the illusion.

Now by suitably tapering the shafts so that they become parts of cones instead of cylinders this effect can be corrected as for any given point of view, or distance from the eye. But such a correction will be either inadequate or over-adequate for all other distances. Taper and batter, when resorted to, are therefore usually made fully adequate so as to tell even at a fairly close view. At a very close view of a cylindrical shaft extending far above the eye the perspective diminution becomes acute enough to take charge, so to speak, and the illusion is obliterated, or seems to be, which is as good in the case of something disconcerting that was never really there.

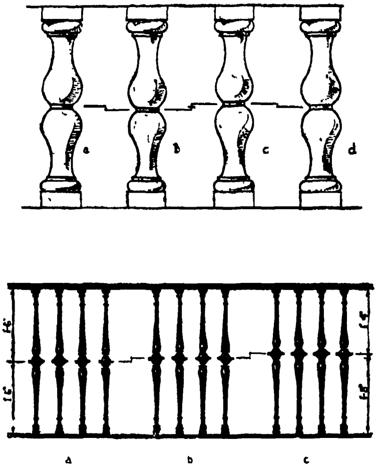

FIG. 55. Stone balustrade: balusters *a* and *d* are symmetrical above and below their centres; *c* is corrected; *b* is the same as *c*, but inverted.

Iron railing; the group of balusters at *a* are symmetrical top and bottom; those at *b* are corrected; those at *c* are still smaller above than below, yet look as if they were those at *a* inverted.

Italian balusters, with a central neck and the mouldings above the neck repeated below it in reverse, are apt to provoke this illusion of top-heaviness very noticeably. The neck should be set out about one-twentieth of the height above the midway point, and the baluster section should be worked out with a taper so that the lower diameter is larger than the upper diameter at all corresponding reversed points. This correction is interesting as being one of the few, other than those for the column, practised by renaissance architects.

Curiously enough, in the case of the shafts and piers carrying arcades in medieval architecture, the upward enlargement illusion is not felt noticeably, and is therefore never corrected. The reason is that the wall-faces and the arch intrados overhang the face of the shaft substantially; the strongly moulded cap, acting as a transition member, gives further emphasis to this fact. The illusion of exaggerated contrast, thus arising, neutralizes the illusion of top-heaviness. The nave arcade at Snettisham in Norfolk is a good example of this.

4. *Subdivided Space*

The illusion of subdivided space has already been referred to as being strong enough to upset the judgement as to size and proportion in the case of figures similar in either of these respects. Horizontal, or vertical, subdivision into only two or three parts provokes the illusion of greater length in the *direction of the subdivision* lines. Thus when we place a strong belt course at the first floor level of a two- or three-story building we lengthen it in appearance. But multiple subdivision into from five to a dozen parts has the contrary effect by provoking the illusion of increased height or breadth in a direction *perpendicular* to that of the *subdivision*. A basement wall with six or eight courses rusticated on the beds will look taller than one in plain ashlar, but not so tall as one of equal height divided into ten or a dozen such courses. So with a colonnade of given height and given width centre to centre of the outer columns. If set out with six columns the thing as a whole will look wider than if set out with four, and not so wide as if set out with eight. 'The thing as a whole' will look wider, but, if the attention is only concentrated on two or three of the columns and the spaces between them, the wider set columns will appear slimmer than those closer set, by contrast with the wider spaces between.

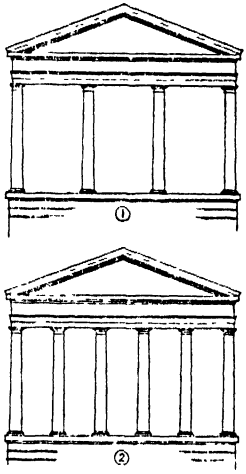

FIG. 56.
1. A pediment borne by four columns. 2. The same pediment borne on six columns.

Much may depend in such problems on the emphasis of the subdividing lines and on the proportions of the subdivided area. The flutes of columns do make the shafts appear thicker, especially at so close a view that only a small portion of the shaft is seen, but they also make the column, when seen as a whole, seem taller than an otherwise similar unfluted one. What is true of a closely subdivided square is not true of a closely subdivided figure from 7 to 10 times as long as it is broad. Great piers, like those at the crossing of Lincoln Cathedral, with their strongly marked multiple subdivision into shafts appear thickened, but the slender piers at Snettisham, divided into only four lobes on plan, not more than three of which can be seen at one time, appear the more slender on account of the limited subdivision. The triglyph looks the taller in virtue of the mildly marked subdivision in three, but put two triglyphs together and contrast them with an equal space and see what happens.

As composition consists very largely in arranging the subdivision of space, one might pursue the matter farther and deal with fenestration, voids and solids, and so on; but perhaps enough has been said to elucidate the principles on which the illusion in question may be disposed of when required, or on occasion used to advantage.

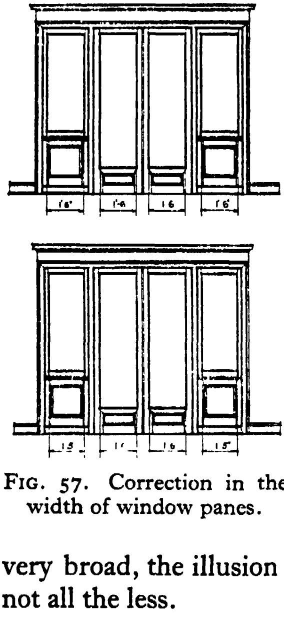

FIG. 57. Correction in the width of window panes.

5. *Contrast*

Objects differ from one another in actual size, or in the proportions that can be observed between their several parts, or in both. A big thing and a small thing seen together, provided there is some common characteristic of form, enhance each other's characteristics of size, but without illusion. Yet when difference of size is negligible or ignored as an element of comparison, a tall thing placed in relation to a broad thing will look the taller and the broad thing the broader. If the tall thing is not very tall and the broad thing not very broad, the illusion of their difference will be all the greater, not all the less.

So, if we have a pair of glazed folding doors, with glass panels 1 ft. 6 in. × 5 ft. 6 in., set between two lights, in the same frame, with glass panels 1 ft. 6 in. × 4 ft., the taller panels will look about 1 in. narrower than the shorter panels. That is to say, they should be made 1 in. wider to look the same, or, better still, 2 in. wider so that there may be no doubt about it, or question as to whether the folding doors are subordinate to the side lights, or vice versa.

In the case of a bay window made up, let us say, of two lights to the front and single lights on the sides a similar correction is often made, but the reason is not quite the same. In this case the side light is apt to look broader than the two centre lights, apart from the point of view, because the centre lights are closely related to the broad unit composed of the pair, which makes them look taller in proportion and therefore narrower than they really are.

Just as in the case of colours not far apart on the spectral circle, where there is an illusion of greater difference than there actually is, so also in the case of figures not very different in proportion there is an illusion of greater difference than there actually is; but the analogy ends with the effect, for the causes are radically different. Colour contrast illusion would seem to be largely an optical phenomenon, whereas form contrast is largely, if not wholly, cerebral.

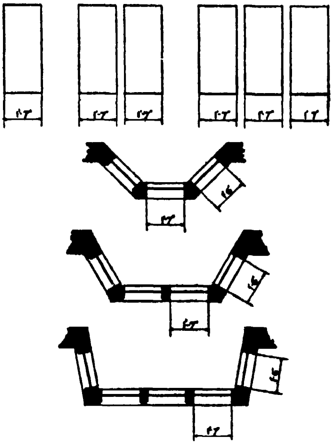

Fig. 58. Corrections for bay window side-lights.

In considering corrections for the subdivided space illusion the tendency has been to regard the phenomenon as affecting apparent size in the first place and apparent proportion secondarily. The illusion of enhanced contrast seems to affect proportion primarily and size secondarily. Whatever is the case, the results are matters with which those concerned in the visual arts do well to reckon. If, for good and sufficient reasons, the designer is aiming at height, or at breadth, or at a similarity in either of these respects, he cannot afford to allow a controllable illusion to discount his efforts. He can raise, or bring down, the ceiling of a room by placing a dado rail low or high, or by allocating less or more space to a frieze and cornice; and the same with an exterior wall-head. In the design of tall buildings it is a mistake to suppose that multiple vertical subdivision will necessarily give an increased sense of height for the whole. That must depend on whether the tallness and narrowness of the parts can make the dominant appeal, distracting attention from the equal tallness with greater width of the block of building as a whole.

In the later medieval towers of France and England the strong horizontal water-tables and string-courses have more to do with the impression of height than is generally supposed. They establish broad, subordinate rectangles which contrast illusively with the main vertical rectangles. The interrelated play of scale and proportion has its part in these compositions, but resort to illusions of subdivision and contrast may be more than suspected. How far this might be conscious and calculated, and how far the intuitive grasp of the possibilities of a well-developed tradition, it is difficult to say, nor need it concern us.[1]

If the reader will first sketch, and then measure up, and then photograph any one of a hundred Picardy church towers he will soon convince himself that, whether intentional or not, all the rectangles are supporting one another directly, or indirectly, in a conspiracy to minimize girth and exaggerate height. With a shock he might find that the visual image of the tower occupies 10° horizontally and only 30° vertically. Had he turned his back on the tower and drawn it from memory he might easily have given his impression by a sketch in the ratio of 1 to 5 without disgracing himself as a draughtsman.

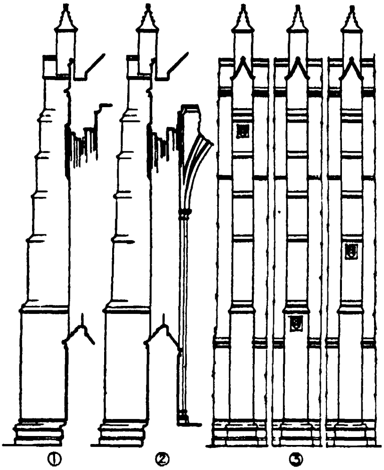

FIG. 59.

1. Buttress with vertical faces. 2. The same with vertical faces modified beyond mere correction. 3. Effect of placing an interrupting spot at various points on a buttress.

6. *Confluence*

The illusion of confluence is that by which spaces between given points tend to be misjudged by the occurrence of figures, with centres of interest of their own, in some relation to the given points. Lines of equal length with attached figures having centres of interest beyond their ends look longer; if within the ends they look shorter. What may be called the effective length of a Corinthian column extends from the centre of the cap to the centre of the base. A column of the same total height and diameter with a shallow Tuscan cap and no base will look considerably taller. The places selected for interesting decorative medallions, or even plain openings, thus have a considerable influence on the apprehended distances related to them, and consequently on the proportional relations of elements in their vicinity.

For example, suppose a buttress with six offsets and that a coat of arms is to be placed on the face below one of them. The buttress, let us say, has a pinnacle of some elaboration and a heavily moulded base. One may exercise one's ingenuity in finding where to place the shield, first of all so as to make the buttress look as tall as possible, then to make it look as short as possible, and lastly to change its apparent height as little as possible. One cannot put the coat of arms at any offset without affecting the apparent height to some degree. A question of this kind is rarely a matter of indifference in the design; and to the designer it may be of high importance.

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[1] See Figs. 38 and 40 above.

7. *Over-estimate of Angles*

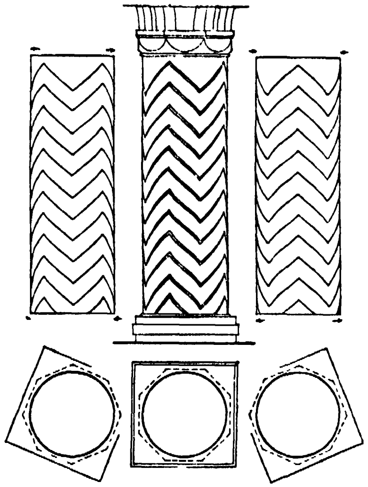

FIG. 60. The Durham piers not only look as if tapered to the top, and to the base, in different views, but appear to lean this way and that as the point of view is changed.

The natural tendency for the retinal images of acute angles to provoke an exaggerated impression of the measure of the angle (increasing relatively to the angle as the angle diminishes) is of greater importance than the illusions so far dealt with. In one form or another this illusion is ubiquitous and incessant, as long as our eyes are open and there is light to see by. It will be remembered that parallel lines crossing another line obliquely result in an apparent displacement of the crossed line; also that when a pencil or group of lines meeting in a point is traversed by a line (making a series of successively more acute angles with the lines of the pencil) the traversing line appears to be bent, if straight; if of suitable curvature, it appears straight. So when actually parallel lines are seen in perspective, as lines vanishing to a point, they distort lines which traverse them.

Consider the zigzag decorations on the shafts of the main piers at Durham. We have here a device which renders the cylindrical shafts conical (pointed upwards) in one view, conical (pointed downwards) in another, and parallel sided but leaning to right or left in intermediate views. The jester who worked that trick had a sense of humour. Let us hope they forgave his devilry, for he lived at a time which knew the use of boiling oil and the rack. A correction could be instituted for any one of the three views, but not for any two, or all, and if instituted for one the effect on the others would be deplorable.

Let us turn to a more serious example in the case of the effect of buttress offsets[1] on the vertical faces between them. Here the top of each face seems pushed out and the foot drawn in by this illusion; the line of the re-entrant angle between the buttress and the wall tends to be set back at the top and drawn out at the foot by its relations with the face quoins which seem to make acute angles with it, though they actually do no such thing. The correction for the buttress faces is to batter them, preferably with an entasis, as was done at the Wayside Chapel at Houghton-le-Dale in Norfolk. The correction for the re-entrant angle line is by the use of string-courses to destroy the influence of the faces and so keep things where they really are.

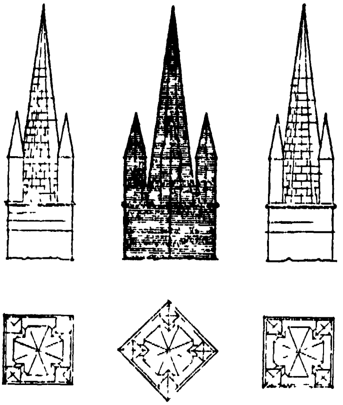

FIG. 61. The correction for corner pinnacles.

Octagonal spires set on square towers always provoke illusions of the class under discussion. The lines of junction between the faces of the cone form a pencil and the quoins of the tower constitute vertical lines. These sets of lines may not actually cross each other, but they are affected as if they did, the quoin lines being apparently thrown out of plumb at the top. The effect in the pencil lines is similar, but not so noticeable, as sensitiveness to verticality is not brought into play. Corner pinnacles and the faces of lucarnes are affected even more noticeably than the tower quoins, because their vertical outlines actually traverse the pencil of lines. Lucarne faces are therefore battered in the work of the best Gothic period; as also in the later work of the Gothic revival after the artifice had been rediscovered. Otherwise they appear to hang outward and suggest instability. When there are strong cornice features and nearby buttress offsets and the spire comes down well within the parapet, corner pinnacles are not affected appreciably.

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[1] See Fig. 59 above.

In the diagonal view of the King's Weigh-house Chapel spire in London, especially when viewed in a haze causing a silhouette effect without detail, the corner pinnacles appear to be thrown out to an alarming degree. If such features mean anything, they signify stable counterweights over the squinches carrying the diagonal faces of the spire, and resort to artifice, to make their stability unquestionably apparent, as well as real, is more than justified. When lucarne and pinnacle forms are combined, as is so often the case in early French Gothic spires, the illusion appears in its most pronounced form.

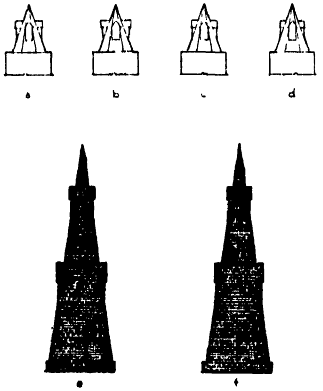


FIG. 62.

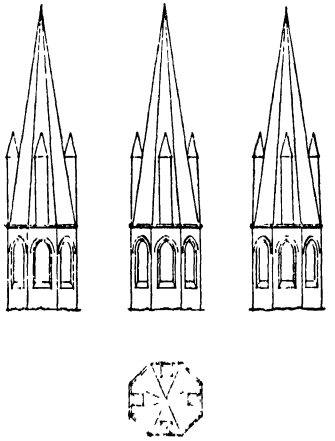


FIG. 63.

FIG. 62. The correction for lucarnes (as at Heckington, Lincolnshire). *a*. Vertical faces appear to hang outwards. *b*. Exaggeration of impression given in *a*. *c*. Corrected by battering. *d*. Refinement by over-correction. *e*. Lucarne faces vertical. *f*. Lucarne faces battered for correction.

FIG. 63. Correction for lucarne pinnacles on octagonal spire and tower.

The voussoired flat arch is an interesting case. It is generally agreed that the soffit seems to droop in the centre. Here the back, or extrados, and the soffit, or intrados, are a pair of parallel lines met by a series of radiating lines—a part of a pencil of lines. Why do the lines intersecting the pencil not behave as they should and curve if anything upwards to the centre? In the first place, the pencil is not sufficiently extended to introduce acute angles: its effect is there, but weakly, and is more than overcome by other factors present. Of these the most important is the fact that from the key outwards the voussoir joints become successively longer, provoking contrast with the actual depth of the arch, which is constant. The distance between the parallel lines therefore seems less at the ends. This contrast does not make the centre of the soffit seem to hang down, but it makes the two ends of the soffit seem to curve up. There is also the question of the outline of the arch as a whole. The two raking abutment lines combine with the soffit line to form a figure extending from point to point at the ends of the head. This merged group of lines would by confluence tend to give a slight sag to the soffit line even if there were no voussoir joints present or visible.

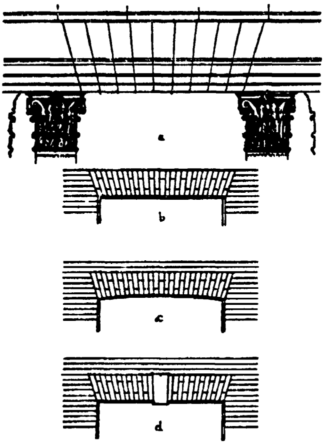


FIG. 64. In the voussoired flat arch the effect is contrary to what might be expected; see text.

The correction is of course the usual slight camber, but it is better to make this sufficiently accentuated so that it will show as a camber; but if this is overdone the back of the arch may show as a drooping line. A keystone with a soffit below the soffit of the rest of the arch (which a keystone from its nature as a wedge should have) is no remedy, but only accentuates the apparent sag merging with the figure above alluded to. Flat arches are not good structural forms and are very apt to have a real sag. So much so that any one familiar with arches rather expects to see it. In vision, expectation has a great deal to do with what one actually sees—interprets as there from the visual local signs.

A façade of a building with battered walls and all the usually vertical lines of openings and other features set out to meet at the point where the quoins would intersect would look higher than it actually was from a central view, because one would assume that all was plumb and parallel, and infer that everything about it was taller than it was in order to provoke so much diminution. A partial application of this principle is occasionally used in Italian architecture. For example, in the New Sacristy of San Lorenzo at Florence there are windows with raking jambs, adorned with architrave frames and segmental pediments, set in the lunettes which fill the arches between the pendentives below the drum of the vault. These are designed to provoke the illusion (which they do when seen from below) that they and the spaces in which they occur are taller than they really are. The inclination of the inner colonnade below the drum of St. Paul's is another case in point. Here foreshortening is discounted. If the later Renaissance architects used very few true corrections, they did not hesitate to provoke illusions involving perspective in the interest of height.

A common practice for giving apparent height to a roof is to diminish the gauge of the slate gradually from eaves to ridge. A gradual diminution of the height, or proportional height, of window panes in the successive stories of a building has a similar effect with respect to the wall. This is sometimes also accompanied by a diminution in the height of courses of the masonry.

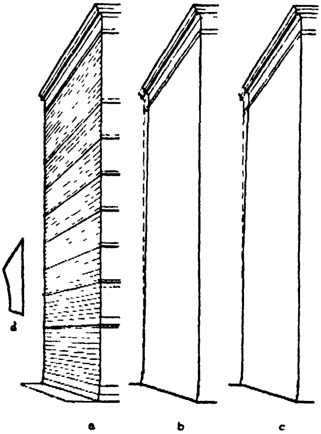


FIG. 65.

a. The illusion of a winding surface and outbending quoin in a coursed wall. *b.* Correction by batter would not get rid of the outbend. *c.* Entasis and batter would cure the out-bend as for a given point of view. *d.* Exaggerated figure to illustrate the illusion in *a.*

The effect of horizontal lines such as window-heads, sills, string-courses, and the bed lines of brick or masonry (especially when emphasized by rustication) is very different in the case of a building viewed from the ground, in perspective, from what it is in an elevation drawing of the building. When seen in perspective these horizontal lines always form parts of a pencil of lines intersected by vertical lines, expected parallel as such, though actually vanishing to a point above the beholder's head. Thus the far quoins of the building appear to curve outwards towards the top, and the upper wall surface takes on a winding appearance. The correction for this is batter with entasis. In any given case, from any given point of view, the necessary correction can be made empirically; but of course this correction will not hold good for the view from another position. Besides, when we give batter (or batter and entasis) to one line, such as the quoin, we only set all the other lines that remain vertical to leaning out more pronouncedly. The application of batter and entasis in such cases is not therefore practicable.

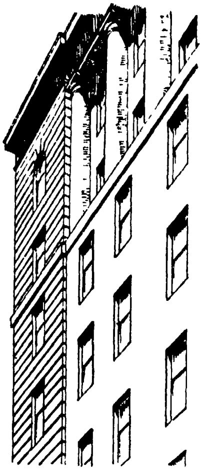


FIG. 66.

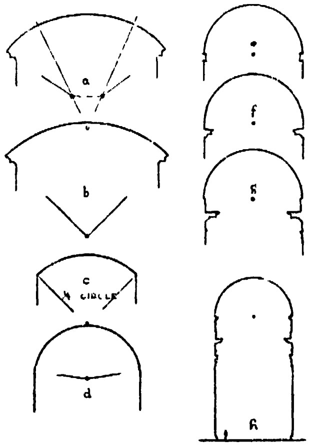


FIG. 67.

FIG. 66. The illusion referred to in Fig. 65 made worse firstly by rusticating the end bay, and secondly by use of an order with tapered and entasized columns just where it will do most harm.

FIG. 67.

a. Usual correction for segmental pediment. *b*. Segmental pediment uncorrected. *c*. The quarter-circle arch demands no correction. *d*. The live spring of the slightly depressed arch. *e*, *f*, *g*, *h*. Stilting related to projection of imposts and height above the eye.

In this connexion it is a great mistake to rusticate the quoins in the case of tall buildings or, as is often done, the end or angle bays. Repeated string-courses at sill levels, and so on, are also to be avoided. Pediments over window-heads have a value in distracting the attention from the horizontal lines of the actual window-heads. Interruptions to the long vertical line of the quoin by means of belt-courses and entablatures may also be resorted to, or the successive setting back of the wall face may be effective. Italian buildings of three or four stories in height treated with superimposed orders hardly suffer at all from the distortions we are here considering. In such cases the profile is broken and the lines of heads and sills are boldly interrupted. In consequence the need of corrections does not arise. A strong cornice also goes a long way to set and keep the wall-head in its real place. Colonnades, especially of pilasters, hoisted up ten, or twenty, stories in the air, when seen in sharp perspective from the other side of a narrow street, suffer extremely from these effects of outhang and winding.

Foreshortening in cases where arches or vaults occur over strong imposts or cornices, especially in interiors, demands some form of stilting, if the arch or vault is to be apprehended as a full half-circle. In extreme cases, this stilting may be brought about by the use of a member between the impost or cornice and the actual spring of the arch or vault. Plinths, podia, or even attic stories may constitute such stilting members, as for example in St. Paul's Cathedral.

8. *Some Miscellaneous Refinements*

In conclusion a few miscellaneous refinements, which though not very general can be recommended.

Segmental cornices and lunettes and the straight lines joining their ends are mutually provocative of illusions. The ends of the curve tend to straighten out; a reduction of radius to give increased curvature is the remedy. The chord, on the other hand, appears to curve up towards its ends owing to the tendency towards the exaggeration of acute angles. The increase of curvature usually disposes of this difficulty as well, and correction of the chord is rare, if indeed it has ever been resorted to.

In window tracery, the old practice of reducing the width of the section used in the mullion as soon as curvature is introduced above the spring of the arch can hardly be too strongly insisted upon. In the near view from below, which is naturally the usual one for scrutiny, the soffits of the curving members come into view, and from void to void the curved members subtend a larger visual angle than is the case with the mullions. Consequently the curved members are apt to look thicker. From the far view they are apt to look a little thicker than they are, because they are in short lengths, while the mullions look thinner than they are, being in long lengths—a matter of proportional contrast. Apart from this, the tracery members of minor lights in the head usually drop one, or more, of the 'orders' which appear in the mullions, and this by contrast provokes a thickening in such tracery members as remain fully 'ordered' with the mullions. The spirit of the thing is somewhat parallel to that in the growth of trees: if branches are smaller than limbs, limbs may be expected to be smaller than trunks.

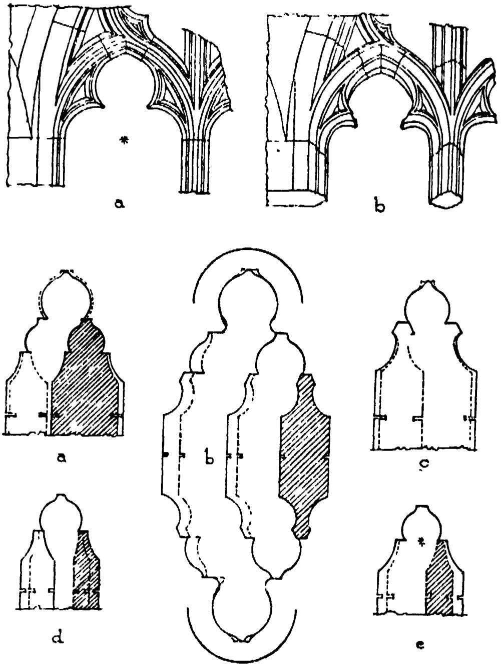


FIG. 68.

Above, tracery of a light-head in elevation and foreshortened. *Below*, English fourteenth-century refinement of reduction of the mullion on entering the tracery.

There is also the case of the arched opening with the large hollowed outer section, so common in the architecture of the time of Louis XV in France. Here, in the ordinary front view from below, the hollow at the head, if the same as at the jamb, subtends a wider angle at the eye; but in an oblique view the jamb hollow shows at least as wide as that at the top. The usual correction is to make the hollow as deep vertically at the top as the chord of the hollow at the jamb, the hollow thus widening gradually from spring to top. So contrived, in all ordinary views the hollow preserves the character of being not less wide at the top than at the jamb; it also mounts congruously with the lengthening voussoirs.

Another problem, which it is useful to know how to handle, is that which arises when circular drums or semicircular elements are associated with rectangular elements in a composition by the device of a common entablature. Suppose a great drum with a rectangle breaking out of it, from which in turn a half drum protrudes, the disconnected bits of the face of the rectangular element will then appear to be set at a considerable angle to one another, though actually in the same plane, and the parts of the cornice over these will appear to cock up in the air in exaggerated contrast with the curvature of the parts of the cornice on the large circular and small semicircular elements. The necessary correction was made in a somewhat similar case which arose in connexion with the lecture theatres at the University of Alberta, as for any ordinary view from the pavement opposite, by modifying the rectangular element so that it should look flat on the face. The quoins in this case were set back 7 in. from the true face.

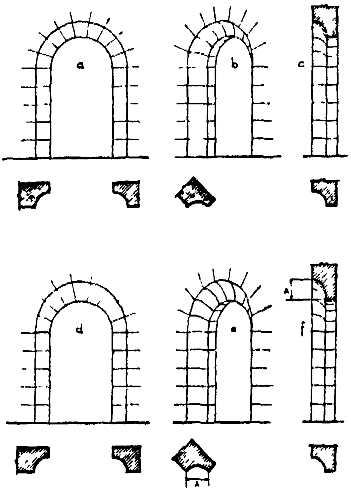


FIG. 69.

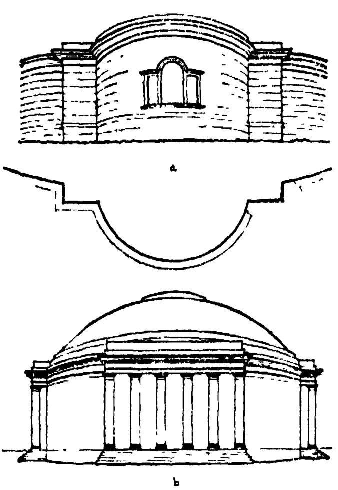


FIG. 70.

FIG. 69. The eighteenth-century French refinement of enlargement of the hollow jamb mould in the head of the arch.

FIG. 70.

a. Correction for straight wall associated with curved wall.
b. Unfortunate association of rectangular, cylindrical, and spherical elements.

9. *Columns and Pilasters*

When columns with an entasis are engaged with a wall, it is usual to engage them to a depth of only one-quarter diameter at the base. Then, in any view up to 45° from the front view, the right and left profiles remain the same and the column looks plumb, as well as being so. If engaged to a depth of half a diameter, then, in like views, the outer entasis is more pronounced than the inner one and the column also shows as more slender than in the front view, and, worst of all, its axis, read as between its profiles, leans in towards the wall.

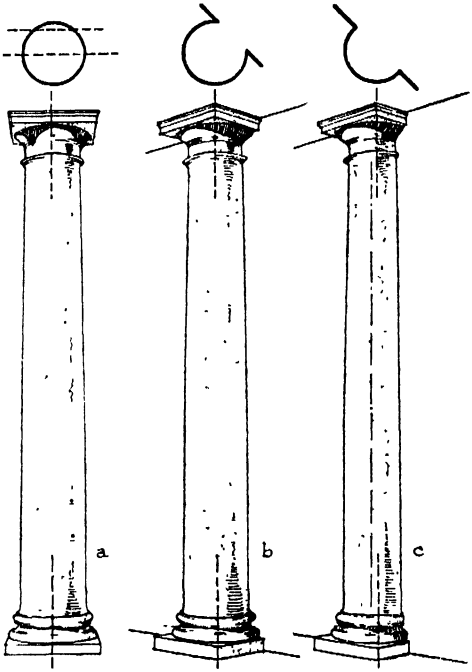


FIG. 71. Engaged columns.

In handling classic orders involving free-standing columns with entasis and pilasters without batter and entasis, a difficulty often arises as to the relation of the face of the pilaster to the face of the frieze. The face of the frieze is usually in a plane with the face of the round shafts just above their bases: a pilaster two modules wide with a cap of less projection than that of the circular columns, measured from the face, is not unusual. But such a pilaster, except when viewed in dead elevation, is apt to look a good deal wider than, and therefore in different proportion from, the columns. Pilaster shafts may well be made somewhat narrower than the base of the circular shafts. The frieze will then oversail the face of the pilaster slightly.

If it is decided to give batter and entasis to the pilasters the question may arise, how much? If the same amount is given on the face of the pilaster as on the circular column, then, in the diagonal view, it will result in much more—1 as against √2—and some incongruous effects may be expected. Perhaps the best way is to give the pilaster an entasis which on the diagonal view will be the same as that for the columns, and in other views less.

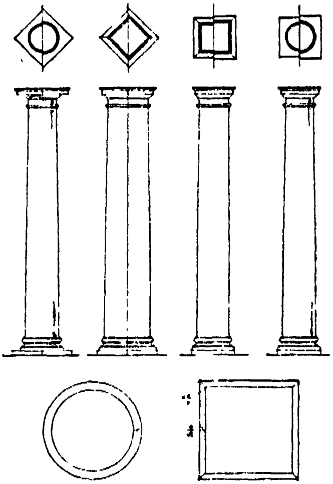


FIG. 72.

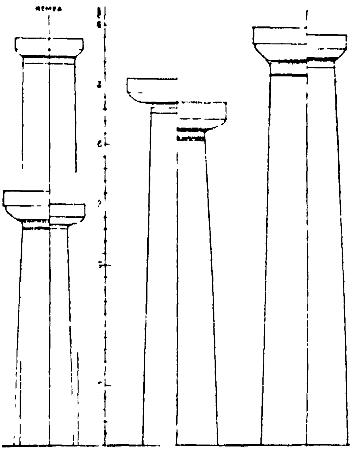


FIG. 73.

FIG. 72. Entasis for square pilasters regulated on the diagonal.

FIG. 73. Range of scale and form in Greek Doric columns.

All this sounds like Vitruvian lore and might well occur under the head of proportion. The main object in dealing with the matter in this place is to show that a refinement which is applicable to a circular column may require modification in the case of a square pilaster.

And last of all comes the question of entasis in columns. The entasized Doric shaft is historically a parent of all subsequent entasized shafts. History and evolution may appear to be against the suggestion that, in the Periclean period at least, the apportionment of entasis was an attempt at expression of structural consistency of stress, regardless of stressability. But bear in mind that, roughly speaking, what the archaic Doric column supported rarely exceeded its own mass. In the case of the Parthenon, as in any pedimented temple, the columns of the peristyle are not all equally loaded. Those at the centres of the pediments carry most load and those on the flanks least. As these latter are numerous the average loading is only slightly in excess of what these latter bear; but if we take the mean neck load—half-way between the greatest and the least load borne on any of these columns at the neck—and the weight of the shaft we get this result. The mean load bears to the weight of the shaft the ratio 3 to 2. Now if we work out the area at the true neck and the area at the base we find these are in the ratio 3 to 5. The neck and the base are thus equally stressed in the case of the mean-loaded shafts. This consistency, of which any one can satisfy themselves by doing some mensuration and

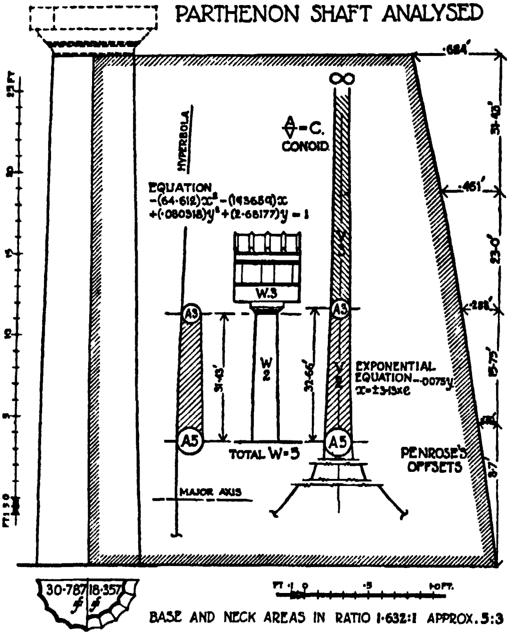


FIG. 74. Taper and entasis of the Parthenon shaft.

arithmetic, taking into account the weight of the marble used, suggests that the designer of these columns may have arrived at their general form in a thoroughly engineering spirit though disregarding what there was no means of ascertaining—crushability.

Now what of the entasis—the curvature superimposed upon the batter arrived at as aforesaid? One may say it was a correction; but it is more than that, for it is obvious. One may call it a refinement and leave the matter there, saying that it 'satisfies the eye'. Does it? And if so why?

Assuming that Ictinus or Calicrates, or the pair of them, sought uniformity of stress as between the areas at the actual neck and at the base, one might expect him, or them, to be seeking uniformity of stress throughout the whole shaft. If so there was some fairly recondite geometry and mathematics then available for such a purpose. There is no doubt that the Greeks of Pericles' time knew nearly as much about the geometry of conic sections as we do to-day, but the exponential equation which enables one to set out a column with a constant ratio of area to volume was still twelve hundred years in the future. Such a column is concave in section and not convex.

Now it is curious to find that a column of this form (which represents what actually goes on in the shaft under consideration) would have its greatest variation from the straight profile of a true cone at about two-fifths above its base, just as in the case of the executed shaft in question; and that its amount would be about the same—seven-tenths of an inch; but this would be inwards, not outwards, from the true conical surface.

At this point it will be well to remark that while, generally speaking, early Doric columns have a very full entasis as compared with later ones, true conical shafts (i.e. without entasis) do occur in early examples; and Ictinus himself, after building the Parthenon with entasis on the columns, built the temple at Bassae with plain conical shafts. But no concave entasis appears ever to have been attempted. The difficulty of executing such a shaft by the Greek method of cutting down to the flutes after the column was set and making a presentable job of it would have been insuperable. There is much to be said on practical grounds for the contention that for a fluted shaft a full entasis is easier to execute than a delicate one, and a delicate entasis easier to carry out with apparent accuracy than a true conical form.

It may be observed here that it is generally accepted that when the Greek used entasis on columns the curvature increases towards the base. In subsequent classic tradition it is usually the other way —a corruption?

Now, reverting to the question of what the designers of the Parthenon were attempting to do, it seems quite possible that, with the mathematics at their disposal, they may have been aiming at equal stress throughout the shaft. If one superimposes a series of cylindrical blocks *of equal weight*, but each with a diameter greater than that above it, such that the differences of area are the same, one readily discovers that as the rings representing these successive differences grow larger they also grow thinner, for their areas are the same. If the cylinders were all of equal height a pronounced convex entasis would be the result. But in the case we are supposing they must diminish in height successively as one goes down, for they are assumed of equal cubic content. The question arises, do they diminish in height fast enough to neutralize convexity of contour. Further, there is the weight of each successive wedge section ring to take account of. As Newton had not been born the means of making this calculation was not available. Ictinus got his greatest variation from the straight line between neck and base at about the right place and he got about the right amount of variation; but he conceivably failed to realize that, delicate as the true curve is for constant stress, it is concave, not convex, to the shaft.

And now we come to Penrose's investigations. He was primarily a mathematician and had interested himself in geometric methods for predicting lunar eclipses. His measurements at the Parthenon were carried out with amazing delicacy and care and he arrives at the conclusion that the designers of the columns found a segment of the arm of a hyperbola to pass the neck, the base, and the point, two-fifths up from the base, where the deviation of the curve from the line joining base to neck was seven-tenths of an inch. This hyperbola has its major axis horizontal and below the base at a distance of a little more than two-fifths of the height of the shaft.

It is to be borne in mind that we are dealing with a curvature of less than seven-tenths of an inch in 31·43 feet. The requirements could be fulfilled by using a suitable segment of either of the other conic sections—parabola or ellipse. The parabola is ruled out for lack of a mechanical method convenient for setting it out. The ellipse can very easily be described with string or trammel, but an ellipse with its major axis horizontal below the base does not flatten out quickly enough to satisfy the condition of passing the neck and would be as big as a town; while an ellipse with its major axis vertical would give quicker curvature at the top instead of at the bottom. The hyperbola can be described by continued motion;

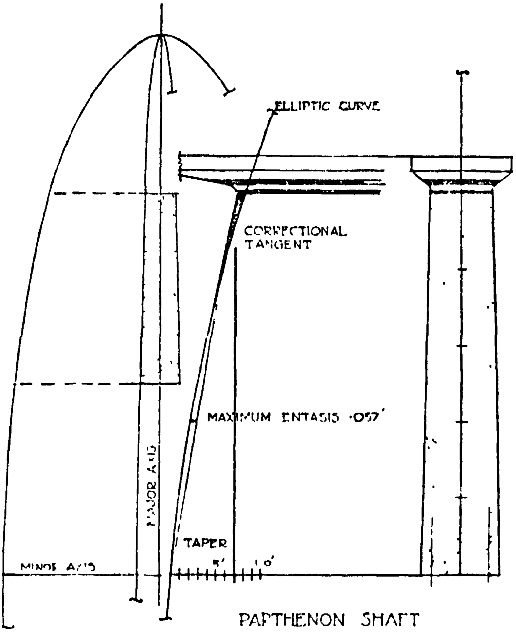


FIG. 75. Setting out for entasis by means of a conoid with tangential correction.

but it is an intricate operation. Of course, for practical reasons the curve could not be set out full size. What would be required practically would be a curve condensible above its axis to a scale large enough to allow the offsets to be measured.

It may be noted, and this is important, that Penrose gives his readings for offsets for one column, not the mean readings for a number. It appears by his admission that no two in the Parthenon are exactly alike; and the one he measured, though as good a one as he could find, was considerably bruised at the base and several of its drums were shifted; of course, not all of these were shifted in the same vertical plane. Conscientious as these measurements were, their result may fairly be taken with a pinch of salt; besides, there is 'builders' error' in the Parthenon—very little of it—but certainly enough to awaken consideration as to what is and what is not evidence in such a case of minute differences measured.

There is an alternative geometrical construction which will satisfy the conditions quite as accurately as the 'builders' error' would admit. It has the merits of simplicity and ease. It also has a certain inherent probability, as it assumes the shaft to be conceived as a regular conoid throughout a part of its length with the axis of the column coincident with the major axis of the curve used, and the rest, the upper part, corrected (into a cone) against the optical effect of the reverse curvature between the annulets and the neck.

If one generates an ellipse with its main axis on the axis of the column, such that it will pass the base, the point of widest curvature two-fifths up and the actual nick of the neck (not the face at the neck) it will be found to be about 178·0 ft. long, 6·8 ft. wide, with its foci about 3 in. from its ends. Only a part of this ellipse is needed and it might well be condensed to one-twentieth in length or even to a circle. The curve could then be scratched on a marble slab 8 ft. square. Base, neck, and the several drum joints could next be ruled off and the correction for the upper part be laid off as a tangent to the curve. The measurements for the work could then be taken.

We know, of course, that before setting the drums and cap the flutes were worked for an inch or so at the base and brought down from the annulets as far as the neck, which was a necessary 'work-form' to prevent the points spalling off in setting. The rest of the shaft was surplus to the finished radius and unfluted when set. It is interesting to conjecture just how the shaft was next reduced to conoid form, the arises of the flutes struck, and the flutes relieved. Something in the way of an adjustable template, gyrating as if secured to the axis of the column, would appear to have been necessary.

If we ever discover the actual method used in executing these flutes after erection of the shafts, which were certainly carried out with a precision beyond anything achieved in the Neo-Greek revival of the early nineteenth century, we shall be in a position to determine the nature of the geometrical setting-out in the stoneyard—the full-size detailing.

Meantime a practical stereotomist's guess is possibly as good as an astronomer's and is offered for what it is worth.

It seems possible, perhaps probable, that Ictinus was seeking to design a shaft of equal stress throughout and that he very nearly did so. That the stress he was dealing with was a very small one and that the material he was handling was capable of bearing a hundred times that stress with impunity need not disconcert us. He had no means of knowing what his material would stand; he was primarily concerned with stability in earthquakes; he was not conceiving Turks and the use of his masterpiece as a powder-magazine. But for that accident it is improbable that there would be a spalled joint in his shafts to-day. The ideal of a uniformly stressed shaft could hardly have escaped the attention of the Greek builders. How they worked out their curves is after all a secondary matter. Why the curves occur is the question of real importance. Ease of execution, without visible error or risk, is a quite probable answer.

The curve may be a selected segment from the arm of an arbitrarily placed hyperbola. It may even be in intention the precise hyperbola Penrose finds. But before accepting this curve at all we would have to know that it fitted a majority of the columns of the Parthenon (and that we never can know owing to their condition); and we should have to know how the setting out in the yard and on the job was accomplished. The alternative curve offered has merits in this latter connexion.

XII

THE SUBJECT IN ORNAMENT

1. *The Object and its Ornamentation*

IT is well for the sake of clear thinking to differentiate between the design of an object and the design of such ornament as the object may carry. These are essentially different activities, which may, or may not, be the work of the same artist. Even when they are determined by the selfsame individual, he is operating in quite distinct fields of thought when he contrives his object and when he contrives its ornamentation; yet his decisions in both fields must take close account of one another. The object may be a perfect expression without respect to its ornamentation, while the ornamentation may be a partial or even a complete failure for any one, or for several, of the reasons now to be considered. Or again, the ornament may in itself be a *tour de force* while the object to which it is related may be misconceived; just as the dress, accoutrements, insignia, and jewellery of a dwarf, a cripple, or a congenital idiot may have values which can be appraised, but which cannot redeem the misbegotten underlying structure, even if they serve to cover it up and distract attention from it.

There are, of course, many objects of art in which the ornamental elements exceed in importance those which have to do with fundamental form—objects whose main purpose is to carry ornament, or which, being placed in due relation to other objects, do in themselves constitute ornaments. A vase on a mantelpiece, a summer-house in a park, a campanile in a market place, and a hundred other examples may readily come to mind to confuse the main issue before us.

Still, there is a good deal to be said for the catching of hares before attempting to cook them and for discovering the form of an object before adding to it the spice of human interest; for that, after all, is what ornament seeks, but often fails, to be.

2. *The Purpose of Ornament*

Let us proceed to investigate and to define the purpose of ornament. Finer shades of meaning will be developed later, but for a beginning one may say that the art of the ornamentalist is chiefly concerned with the expression of those sentiments which may arise as between persons and things embraced in that general category which is called the apparatus of life. Much of this, for good and sufficient reasons, is never ornamented at all, and much of it is ornamented unreasonably, or even without any reason. By saying that it is the function of ornament to express sentiment one at once establishes a useful criterion to apply both to the unornamented thing, which might be ornamented with advantage, and to the ornamented thing whose ornament, whatever its intrinsic qualities, is a mere bedevilment. For, when there is nothing to say, silence is golden.

Now these sentiments which arise, and often exist so forcibly, between men and the utilitarian works of men's hands, may find expression out of deference to the artist, or maker, on the one hand, or out of deference to the user, or owner, on the other; and among users and owners there is, and probably always has been, a sympathetic minority who care far more about the sentiments of the artists and makers with regard to the things they devise, than about what may be called their own proper sentiments as owners and users.

The inquiry into the nature of ornament and its relation to the design of a thing as a whole may well be divided in accordance with time-honoured custom under the headings of the 'moral' and 'material' logics—*motif* and treatment. This requires the qualification that *motif* is a technical word meaning the subject-excuse-occasion, and is not to be confused with the true content, or mood, with which the ornamentalist, like any other artist, may succeed in investing his work.

That this subdivision of the inquiry into the fields of *motif* and treatment, theme and execution, may be useful is at once apparent when we consider that the theme selected (as for example, wheat and vine in the case of a chalice used in the celebration of the communion in a Christian church) may be quite appropriate, while its treatment may fail with respect to scale, placing, lack of observation of what is characteristic in the forms of the things represented, or failure to take advantage of the very limitations of the material and of the processes involved. To convert the representation of a natural, or artificial, object into an ornament, one must know it thoroughly (that is, be able to draw it), and one must also know thoroughly the technique for its embodiment—chasing, beating, enamelling, or whatever it is.

3. *Ornament Significant of Personal Relationship*

Choice of theme for decoration depends on associations of ideas. These associations may be very direct, or very indirect, and there is only one way to come by them—that is, through the possession of a well-stored mind. Just as an author cannot ply his trade, far less enrich his language with new phrases, without a considerable vocabulary, so the ornamentalist requires a knowledge of old symbols, even if he would invent and apply new ones. Ornamental *motifs*, words, and phrases, they are all one in origin and in use.

The sentiments of owners and users may be distinguished. From time immemorial the marking of objects to distinguish them as possessions has been practised, always no doubt with great satisfaction to the original possessors, and often to those into whose hands they have fallen later.

The totems of savages, the insignia of systematic heraldry, trade marks, monograms, initials, and, in short, any kindred methods of indicating relation between persons and things, all bear witness to this. The art of several great cultural epochs would be a sorry thing without them. Nor is this practice confined to the individualism out of which it sprang, for all uniforms, coinages, and emblems connected with empires, states, cities, and institutions have the same intention and aim. There is thus a vast mass of more or less direct possessional symbolism available to the ornamentalist when the problem presents itself of showing a specific, or general, possessive association between things and persons or groups of persons; and this body of material is by no means only related to the hoary past. It is in many senses as active and alive to-day as ever it was.

Considering, for a moment, what all this subject-matter comprises, one finds that representations of anything in nature, or made by man, may enter into the fabric of the body of symbolism; but it must often be confessed that the original direct symbolism is lost, and has become replaced by an association of a secondary kind, not infrequently capricious. It is, for example, often regretted that only a very small percentage of British citizens understand the elements of the Union Jack—a somewhat recondite agglomeration of heraldic 'ordinaries'. Very few of them, however, do not understand what it now stands for. When an ornamentalist has occasion to use this symbol it is desirable for him to understand its full meaning and origin, as otherwise he is likely to err in setting it out—but that is a technical matter which does not determine the propriety, or impropriety, of its use in given circumstances.

4. *Ornament Significant of Use*

What has just been stated with regard to the subject-matter of possessive symbolism is equally true of the subject-matter of use symbolism. It may consist of anything under the sun, but, from the nature of things, the association of ideas is generally more obvious. In the field of use symbolism there is a truly enormous scope. At the one end one finds the great body of religious *motifs*, mythical and historical, and standing always as visual reminders of things unseen; and, at the other, the direct trivialities of daily life—such as the game-birds which gunsmiths habitually engrave on the side-plates of fowling-pieces for the delight of sportsmen, or the baskets of fruit which Pompeian decorators painted on the panels of the walls enclosing the festive triclinium, no doubt for the delight of those who used to eat the less brilliant but tastier varieties of apples with their old Falernian wine. Thus ornament, like the spoken word, may hint at the ineffable, or merely state the obvious, and its phrases have values great or small, quite separate from the technical values of cadence and rhythm or colour scheme and composition brought into play by artistic elaboration.

But to state that these values are separable is not to admit that they should not be related justly with respect to all occasions.

5. *Functional Ornament*

So much for the more or less conventionalized representations of things which serve as the raw material of the ornamentalist for the satisfaction of owners and users, or at least with that intent. What of the forms which the designer, when acting half as architect and half as ornamentalist, evolves to make the designed thing more interesting *in itself*, and for himself and for those of his craft? One is here no longer dealing with fruits and flowers, books and seven-branched candlesticks, but with the modulations of structural members (presumed to be already broadly determined in respect to their shape and size) with due regard to what they do and what they are made of and how they are made. For the most part these modulations of form are achieved by means of mouldings. Their origins and technical qualities are not of interest for the moment; it is the question of what these expressions are about, their subject-matter, their intention, that first requires elucidation. What do they do?

One may use a long word and say that these things render a structure anthropomorphic, or one may simply say that they make stone speak, if stone be in question. What is now under consideration is architecture, and architecture is only a part, and a small part, of the vast subject of this cursory treatise. Architecture, in this sense, is a word as applicable to small things as to great; to a tea-spoon or to a town hall.

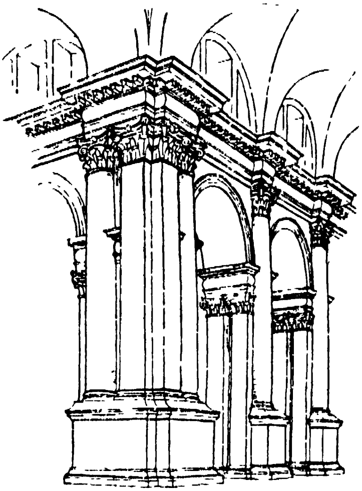


FIG. 76. S. Giorgio Maggiore, Venice. Use of orders to differentiate the functional duties.

All structures are made up of parts or members, some of which are busier than others. Some elements of structures are only required to 'stay put', like a fat baby in a crib. Other parts carry loads, transmit stresses, protect important joints, serve as connecting pieces, and so on. Moreover, when any element in a structure is distinguishable as such it is safe to say it has a beginning and an end. There is a very close analogy between the members of a structure and the phrases, sentences, paragraphs, chapters, verses, or cantos of a literary composition. In both cases clarity is vastly helped by punctuation, alike to distinguish the separate action of the elements and to connect them.

Walls, piers, columns, sills, lintels, arches, vaults, water-tables, and copes, to take examples from buildings, are all real elements, and may be structurally inevitable in any given case. Capitals, bases, plinths, imposts, architraves, cornices, and string-courses are not inevitable to the same degree, though they may once have been so in prototypes. Flutings, shaftings, archmoulds, and mouldings generally have a still more tenuous basis in fact, although often traceable to early usages in which questions of material, or method, or both were once involved.

These forms persist as conventional symbols of what goes on in structural elements; often something quite different from what went on in those in connexion with which they originated; just as words have become conventional symbols outside their onomatopoetic origins.

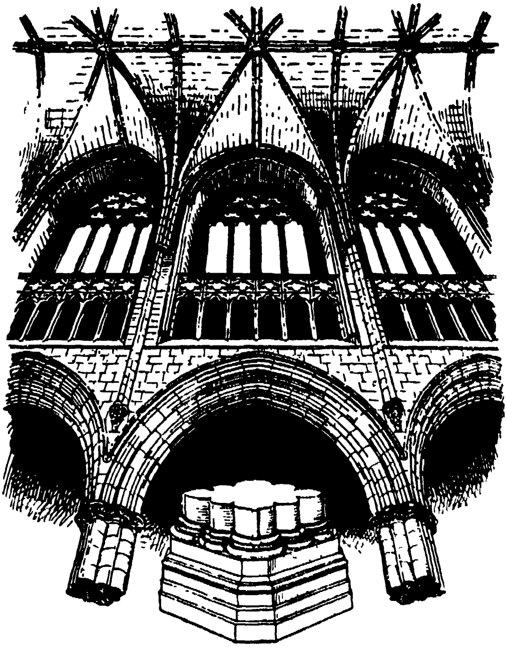


FIG. 77. Guisborough Abbey nave bay.

Consider, for example, a nave pier from Guisborough Abbey with its ramifications in the superstructure, and listen to what the various members might have to say.

The sub-base says: 'You don't see my roots, so you can't know what's below me, but you do see what's above me, and a terrible load it is. Ground is softer than the stuff the pier over me is made of, so I spread myself out this way to distribute weight. Oh, yes! I might have been square, but think how people would have tripped over my corners and bumped themselves; that chamfer on my top makes it more comfortable for you. True! I have two chamfers. That enables me to do what I have to do in two hops instead of one jump that would draw too much attention from what the group of bases just above me are doing. I have to think of their feelings as well as of what's below. Well, I am rather plain, and my manners aren't elaborate like those of my friends above; but I'm honest and sincere and would have to be in this place of terrible responsibility.'

The bases say: 'We're a happy family, we are, we are, we are. The sub-base is very decent and accommodating but, our word, we have to work. See, each of us has a shaft to take care of. Oh no, they aren't separate, really—neither are we for that matter—but those shafts do different jobs in a kind of way. At least that's what they tell us. Well, they'll be only too pleased to tell you about that, so ask them. Yes, we're rather squeezed, but all right while we keep together! Some of us have fillets and some of us have noses, all out of politeness to the shafts above us.'

The shafts say: 'Oh yes, we all do separate jobs, but we pool our efforts, and long before the pressure in us reaches those chattering bases it is distributed and spread among them. But even if it wasn't, each one of us is about the right size for his part of the general job, so no one works harder than any one else, and we don't quarrel and split up. Yes, the bases have to carry us, as well as our loads, and you're quite right, our lower end has to take that, too. Taper? Oh, we see what you think, but why be so particular? We're not wholly occupied in transmitting a vertical stress, far from it. We've got to be big and heavy to last a long time, that's quite as important. Well, that's the way the masons and the master mason who made us felt about it. Correction? Well, we don't look fatter at the top than below, do we? You say we should, but we don't. Yes, the masons talked about that, but the master mason said, "Nonsense, you'll see. Just wait till we get the caps and the heavy arch wall set on oversailing the shaft." We're glad you don't think us top-heavy in appearance. We would be more apt to, if there was just one of us and pretty big, instead of a family.'

The caps say: 'Here we are! Here we are! And quite content not to be decked out with hawthorn or lilies. It's jolly to be a cap, up here, and much better than being a base; less to do but equal responsibility. The fellows that set us were pleased with us and with themselves. "A long concentrated job", they said of building that clustered pier below us. No, there was very little cutting to be done to it after we were on, and don't we fit nicely on to the fillets and keel moulds? We just love them and let them come up through our dear little necks and die away sweetly on our bells. We're a hard working lot, really; there's no harm in being pleased with ourselves. Some of us take the big arches—three orders, all full of mouldings, they have. And one of us takes the side aisle vaulting ribs, or thinks he does; but the conoid puts some of that work on to the rest of us. But the best of the bunch of us—we are a bunch and never speak as individuals—has a job that we're all proud of, but it's not really a very hard one. The group of vaulting shafts from above comes down directly over him. You're right; a very important position; like being chairman of a meeting.'

And so on through the triforium arcade, and the clerestory window arch, and the main conoid, and the vaults up to the ridge, every member clearly defines itself as to what it does in such a way that it can tell a story, or sing a song about it, and, like all stories and songs, what it says or sings doesn't always have to be quite true. But to be worth saying or singing the story does have to impart something in the way of a feeling or a mood or a frame of mind.

What the several elements of the Parthenon say individually, or chant about in chorus, is very much the same sort of thing that the several elements of a Gothic church can say, or sing about. That is to say, it is mostly about the job in hand. But the mood is altogether different. Where the members and mouldings of Guisborough Abbey chatter and gossip freely about their jobs, those of the Parthenon murmur complaisantly of the virtues of neatness and order and harmony with a certain evasive reticence. Besides, the modulations of structural members in the Parthenon have also, if pressed, a good deal to add by way of explanation of their own extreme unreasonableness on hereditary and customary grounds. 'Indeed,' says the triglyph, 'It's a very long story why I have these grooves, and I have forgotten whether my great-grandfather was the end of a beam or a board set grain up and down over the end of a beam, and some of my friends just above me don't know why they are so full of pegs, because their wooden great-grandfather could not have been quite like that. But, be that as it may, we are all unanimously concerned with one thing, and that is to carry an air of serene assurance to which our very great stability entitles us; and, if possible, to give the impression that we are even more stable than we really are. That is what we care most about.'

In dealing with the simple facts and fictions which the modulations of structural members may express, we have been tempted to go a step farther. The mood of given executed ornaments and decorations—do their themes 'blush with the blood of queens and kings', or reek of holy incense, or brag amiably of structural matters?—is not the question now before us. We must continue our review, in broad classification, of the raw material out of which decorative *motif* is spun. The contributions of the owner, the user, and the designer have been recounted, and we now pass to the contribution of the maker. For the owner the thing is marked with his mark, for the user it is marked with a relation to other things or acts, for the designer it is marked with what goes on in itself. What is the nature of the mark the craftsman puts upon it? Of course owner, user, designer, and craftsman may be all one, say a Labrador fisherman's wife providing herself with a hooked rug without recourse to a departmental store pattern or any other source of confusion.

6. *Enrichment*

Later there will be a good deal more to say on the all-pervading influence of technique in the amelioration and modification and conventionalization of the subject-matter of ornament, however contributed, when materialization comes into play. Here discussion is confined to the different kinds of *motif* and their inspirational sources. Now there is a considerable body of ornamental *motif* which cannot be explained or interpreted as representative of owner's, user's, or designer's subject-matter, and which may without any great stretch of the theorizing imagination be put down as craftsman's *motif*. We refer to orderly markings with tools in which pattern of one kind or another may manifest itself over the surface of an object or over a distinctive part.

Very often what appear at first sight to be such mere markings prove, with further knowledge and fuller analysis, to be highly conventionalized representations of things, and not primarily tool marks at all. What is described as high conventionalization may often with equal force be called degeneration—this by the way. Any one familiar with craftsmanship, whether prehistoric, ancient, or modern, will readily realize how easily the craftsman is tempted to a mechanical process giving character to a surface, while at the same time indulging in a display of his mechanical skill. The resultant is an otherwise meaningless pattern, more or less geometrical—a regular arbitrary arrangement of lines, grooves, dints, spirals, or the like. Enrichment of surface may often be regarded as a primitive method of indicating value or regard for the object so treated. It is not infrequently resorted to with intent to differentiate the functions of parts in complex objects, thus invading the field of functional ornament.

7. *The Appreciation of Subject in Ornament*

No attempt has been made, while dealing with *motif* in ornament, to furnish a list of subjects, with comments on their significance and appropriate use. By classifying ornamental *motif* roughly under four headings, each broadly related to an incentive, a basis has been established for an analytical habit of mind in such matters. There is so much ornament associated with the apparatus of life of every cultural epoch of the past, not all of which is justifiable with respect to its subject-matter, that the student of such things should be encouraged to do some critical thinking when exploring ancient monuments or museum treasuries. If he finds flaws in the categories offered let him make his own and so realize that the theme of ornament is a thing that can be judged apart from both its execution and its application. There have been cultural periods in the histories of various peoples when a great sensitiveness to the meaning of ornament was in evidence; and there have been times when the main preoccupation of the ornamentalist has been to obscure the meaning of such form as the things ornamented were endowed with. In these, the debased periods of taste and art, demoralization was never confined to artistic activities alone.

Taking modern civilization as we find it, with its mechanization of industry and its mass production, it is not too much to say that individualism has an ever-decreasing place in the apparatus of life. If there are fewer specially designed objects with a place for a play of individual fancy and sentiment, there are far more things made in which the exercise of an ascetic and critical judgement directed to the elimination of meaningless decoration is appropriate. The practical effect of this chapter must therefore be largely negative. For the student of things made with hands by men of old there is here perhaps a more positive message of interest and delight.

If the poetic instinct for selecting or, where necessary, inventing the subject-matter of ornament must indeed be regarded as something that humanity is growing out of, one need go no farther than just inside the doors of almost any modern place of worship to be further confirmed in this supposition. There one will often behold the very apotheosis of the fatuous in the selection of theme for ornament. Yet all the while the Book of Revelation reposes on the lectern, crammed full of the very stuff to inspire the decorative themes for a hundred churches.

Enough has now been said to establish the subject-matter of ornament as an element in design having a value of its own, independent of all considerations appertaining to its materialization. The treatment of ornament in relation to the material provided and the technique prescribed will next be discussed; the treatment in relation to the object ornamented can then be taken up as a third aspect of the ornamentalist's problem.

XIII

MATERIALIZATION OF ORNAMENT

1. *The Logic of Material*

THE subject-matter of the ornament and decoration, required in any given case, once decided upon in accordance with the principles already discussed, or on no principle at all, the next step is to consider the practical materialization. This at once involves the designer in the process of conventionalization; for a realistic representation of a thing is not an ornament at all, but an independent work of art. Ornament is essentially dependent.

The conception and design of ornament may be regarded as involving two groups of considerations. The first has to do with the physical relation of the ornament to the thing to be ornamented, and embraces such matters as position, distribution, size, and scale; while the other group of considerations involves the million possibilities and complications which arise under the questions—what is the material, and what is the technique? These groups of considerations may be shortly defined as matters of position and matters of adaptation—the latter are now under review.

In the investigation of the part that material plays in generating ornamental forms it will not be possible wholly to exclude questions of significance; in what immediately follows the emphasis is on the form acquired, not on the thing represented.

2. *Invention*

As invented ornamental forms, one may designate those in which there is no extraneous subject; they represent nothing but what they are—geometric arrangements of tool marks. These may occur as filling patterns, enrichments of surface, bands, stripes, medallions, or mere spots. The elements may be dots and dashes, noughts and crosses, zigzags and keys, checks and honeycombs, all resulting from scratches, cuts, brushwork, or the use of the hot point. A great deal of ornament of this humble kind has been indulged in since the dawn of civilization and there is no sign of those who make things or of those who use things being tired of it yet. It is brainspun stuff, and can be explained as primitive interest in geometry, or as pride in dexterity.

To those who like to be right, and to know what they are looking at, a word of caution may be given. Much of what looks like invented form is really highly conventionalized representation of objects and belongs to another category to be considered presently. Still, the phenomenon of non-representative ornamental form does exist and the designer often finds a good use for it when he desires to emphasize differences between part and part.

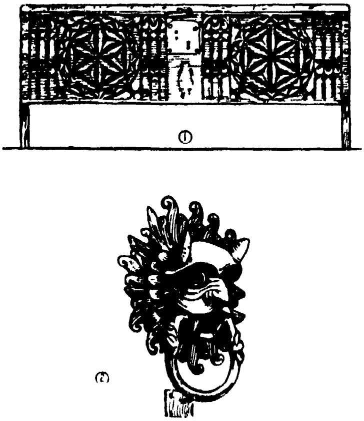


FIG. 78.

1. Unframed chip-carved chest, fifteenth century.
2. Knocker from Sanctuary door, Durham.

3. *Derivation*

Closely akin to ornamental forms of the kind just dealt with are those, often also of a geometrical character, derived directly from technique. They are the offspring of material and are fathered by process. Purpose is here hardly more than an absent godmother. These forms may have something in the way of function, but it is not of a high order. Extraneous subject-matter is absent; they do not represent anything; the moral logic is not involved.

At this point a brief list of technique-derived forms may be helpful in making it clear what is under discussion: in wrought iron-work—the spiral; in beaten metal-work—the boss; in cut glass—the facet; in wood-carving—the groove; in stone-carving—the drill hole; in textile—the check; in brick-work—bond pattern; in riveting—the row of dots. The list might be extended and expatiated upon *ad infinitum*.

The derived form, pure and simple, does occur, just as does the invented form pure and simple. It can best be studied, however, when in ultimate origin it was a representation of something. Ornament is nearly always a cross-bred thing, part representation, part derivation. Sometimes, as in the case of the alphabet, the representation element wanes till there is little left but a technique-derived form. The evolution of lettering thus provides as good an example as one could want of form under technical impulsion. This is not a case of technique generating form, but of form undergoing successive modification in obedience to technique.

Alphabets are systems of symbols for sounds, and, like the symbols that have remained purely decorative in intention, have behaved with sensitiveness to material and technique. 'W' is actually a conventionalized representation of wavy water, and 'S' is the oft-drawn picture, of a picture, of a picture of a hissing snake. But we are not concerned with letters just now as what they originally were—waves, snakes, and so on—but as to how they have changed, depending on the material in which they occur and the tools with which they are traced—a series of incarnations.

Take the alphabet as the Romans left it in their inscriptions, cut into a flat ashlar surface. The handiest way to cut it in neatly is with a V-section for the lines, whether curved or straight. But it is a very 'fikie job' to return a V-section at the ends of the letters without widening them out; so they did widen them out consistently—hence the 'serif'. The medieval monk, writing on vellum with a reed, goose-quill, or crow-quill pen, bevelled to make it easy to draw the vertical lines truly, had quite a different problem of stopping the tops and bottoms of his lines neatly; the jolted end and the diagonal turn came about naturally on this very account. So also with the thick and thin which is characteristic of all script, for the bevelled pen makes a thin line when drawn at right angles to the forearm across the vellum or paper. The ornamental capital letters, when done in colour with a brush, become new variants of the original forms, and quite different from the pen forms—juicy bulging strokes, swelling thick to suddenly thin again, in place of the crisply regulated thick to thin of the pen-drawn black letter. Then there are the pen-drawn, elaborated capitals in which the original letter-form may be almost lost in a grouping of flourishes; true examples of forms derived direct from the material and technique, and otherwise unaccountable and meaningless—just merry tool marks adding value. Modern handwriting, or running script, with joined letters is what it is thanks to the introduction of sharper but square-ended pens which will readily draw downstrokes at a raking angle.

Oriental scripts are made up of brush strokes, and hence their character. Indeed, every much used material for writing or inscribing on, stone, wax, papyrus, vellum, paper, or mint-metal, has tended in conjunction with the tool involved, be it chisel, stylus, reed, quill, steel pen, or die, to modify the forms of letters used to represent alphabetical sounds.

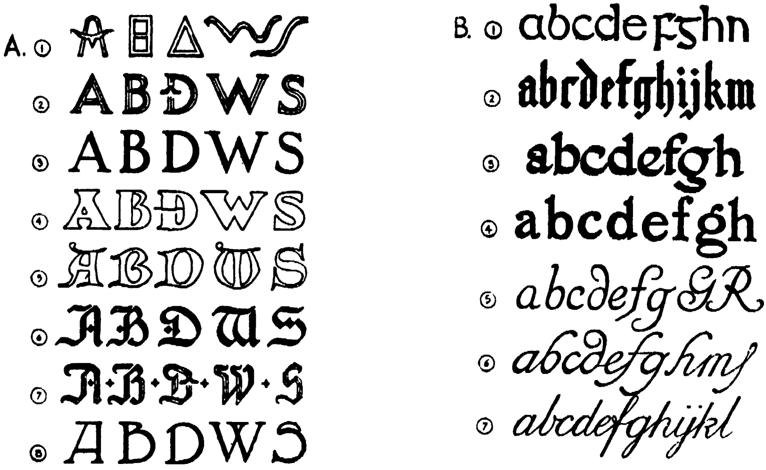


FIG. 79. A. Capitals in various materials and techniques.
1. Original symbols. 2. Roman incised letters. 3. Standard fount derived from 2 and 6. 4. Florentine low relief, twelfth century. 5. Gothic painted capitals. 6. Gothic reed capitals. 7. Gothic incised capitals. 8. Modern square and compass drawing.

B. Evolution of small letters in fount and script.
1. Book of Kells, reed. 2. Black letter, reed or quill. 3. Italian sixteenth century, reed. 4. Modern fount derived from 3. 5. Georgian script. 6. French eighteenth-century script. 7. Victorian copperplate engraving.

4. *Transference and Translation*

By tracing the successive incarnations of what had become, after all, nothing much more than arbitrary arrangements of lines in the alphabet, the way has been prepared for an understanding of the phenomenon of transference of form. The explanation for this can be found in the early chapters on aesthetic, where stress was laid on the associative importance of the accustomed thing. A decorative form generated in one material, with an accompanying technique, becomes customary in a certain structural connexion; the original purpose of the thing ornamented remains, but the problem is solved in a new material with a new technique. Instead of being re-designed in its entirety, residues of the original form remain clinging on in the new materialization. Such residues are in reality ornamental in intention, even when they derive from strictly structural original elements. When this takes place it is usually found that the old material-and-technique-derived ornamental forms survive more strongly in the new technique than do the purely structural forms.

A resumption of the study of our protean alphabet may again be helpful. When the Gothic carver of stone or wood had occasion to deal with an inscription, whether sunk or raised, he did not revert to the simplicity of Roman sunk or raised characters. The letters as he knew them in script had funny little turned ends on them and sundry flourishes, and these pen-derived forms he gaily transferred to his stone or his wood. But, being nearly always an artist and a craftsman, he usually allowed his tools to go their own way when they had a way. His incised letters are not the same as his raised letters, nor are his letters in stone and his letters in wood identical in character. His transference is obvious, but he derives with ingenuity; in a word, he produces a translation.

Now translations, as Croce truly says, are either 'ugly faithful ones, or faithless beauties', and where ornament and decoration is in question the latter are always to be preferred.

Complete transference of ornamental form, evolved and generated out of its original subject-matter in one material and technique into a new material and technique, is always a futility. It may at its best be an exposition of erudition, or at its worst a confession of fraud, but in either case and in all intermediate cases it is an admission of creative sterility. The plaster Gothic cuspings and crocketings of Strawberry Hill, the cast-iron Doric elements of the Moscow Gate in St. Petersburg, are cases in point. It cannot be said of these that they are 'without form', but it may be said that, in a material sense, they are 'void' of meaning. It must not be supposed that the ancients were immune from these rather characteristically eighteenth- and nineteenth-century vices, for which the designers of the later renaissance in Italy and France are often held responsible as showing the way. Egyptian sarcophagi, Lycian tombs, Pompeiian scagliola, furnish examples of wholesale transferences. Whether the intention was to perpetuate a form by its use in a superior material, or, as more commonly the case, to reproduce a form in inferior stuff with intent to deceive, such crude transferences run counter to all congruity in expression. There is here no discovery of form, but merely borrowing or theft.

5. *Adaptation*

Yet transference and translation when accompanied by due adaptation are processes wholly free from aesthetic criminality. Indeed, they furnish the most prolific of breeding-grounds for ornamental and decorative forms and have been doing so since the dawn of art.

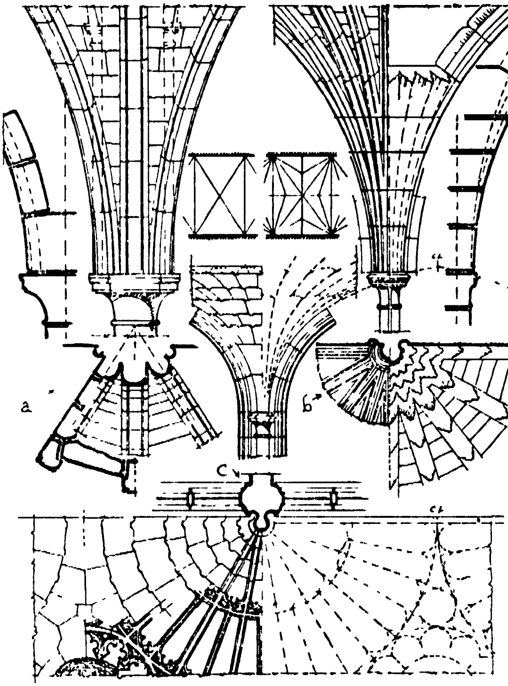


FIG. 80.
a. True rib vaulting, early period. *b*. Conoid vaulting, middle period. *c*. Fan vaulting, late period.

Gothic window tracery with all its stone-derived qualities could hardly have happened if half-timber work had not been general in northern Europe, leading naturally as it does to the window composed of many lights. Once this system of unit panelling was thoroughly accepted for the construction of windows in stone churches, it gradually spread to all plain surfaces and ended by invading, capturing, and ultimately demoralizing even the vaulting. For surely a complete though gradual alteration of the principles of a construction may be termed a demoralization, even if one admits the facile charms that resulted.

The wood originals of certain of the decorative and ornamental elements attaching to the classic orders are at once historically established and obviously deducible. But besides the translation there was here an adaptation that was all-pervading. So much so that when in turn the architect-builders of Virginia and New England, with white pine as their new medium, retranslated these stone ornaments (as they knew them in their books) into wood, the result was nothing at all resembling the original wooden post and lintel architecture of very ancient Greece and Asia Minor, but a new system of design with qualities, characteristics, and ingenuities of its own.

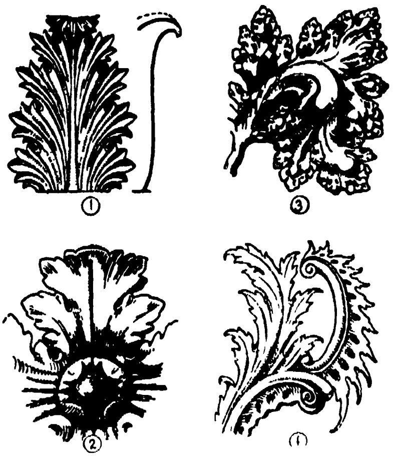


FIG. 81. Foliage in stone.

1. Greek acanthus from a capital.
2. Italian acanthus from a patera.
3. Gothic hawthorn from a corbel.
4. Rococo foliage from a cartouche.

Transference of ornamental form has been exemplified by certain ornamental modifications of the structural members which occur in buildings. Those which occur in furniture, in utensils and vessels, in weapons—up till such time as weapons ceased to be adorned at all—or in ships ancient and modern, might just as well have been selected.

The law of material and technique pervades all natural growth and evolution and it applies to the growth and evolution of all form discovered by the wit of man, ornamental and decorative form included. There is no continuing penalty for disobedience to this law in natural phenomena, for it cannot be evaded without ceasing to be; the penalty in the case of design is aesthetic failure, expressional impotence, the ugly. Take any *motif* in the field of ornament, a vase, a maple leaf, the time-honoured acanthus, a bird, a beast, or a composite monster, such as a winged victory; each, when embodied as ornament dependent on an object, becomes obedient to the law of material and technique, or, failing to do so, is not an ornament but becomes a blemish. The rendering of floral forms, flesh, feathers, and drapery, cannot, without violation to some material or technical consideration, be identical in cast bronze, in beaten silver, in carved oak, in modelled plaster, in hewn stone, and in stained glass. That is what is meant by the term 'the genius of the material'. Each medium has its limitations; these are not fetters to bind the ornamentalist; they are sources of inspiration. One may call them opportunities.

Some examples of ornamental form arising in various materials may now be studied with advantage. In certain of these, little or nothing is discernible in the way of subject-matter, while in others there is representation of extraneous things—plants, animals, and objects of use.

6. *Glass-ware*

In any representative collection of glass-ware in a museum, most of the objects may broadly be divided into two general classes—blown glass and cut glass or crystal. Most cut glass is blown first, before it is turned, ground, cut, and polished. Possibly there may be some cast glass too, in feeble imitation of cut glass, poor trash that need not concern us. There may also be specimens of the mysterious Lalique and Tifani glass exemplifying a marvellous interweaving of processes. It is likely that there will also be some well-conceived blown glass, marred by frosting and engraving injudiciously employed. Attention is here restricted to glass and the ornamental forms arising from its manipulation; gilding and enamelling on glass are not under consideration.

Take a fruit-dish made in Venice about 1510, when the technique of blown glass was at a very high level, rarely attained since. The thing must have been made in a few minutes, though it had taken centuries to learn how. It consists of a dish with a stem and a base. Ornament is restricted to a few circular ribs or beadings that serve to stiffen the frail fabric of the dish, and to the spirited baluster stem whose form has a practical value in giving a secure hold. One must recognize here something very near to pure design as found in nature and in the ideal to which the engineer aspires; but there is also the 'little more and how much it is'. Simple as it is, it is, nevertheless, the fine flower of an exquisite culture.

The basic form of blown glass is, of course, the bubble, elongated, attenuated, or modified in a hundred strange ways by a roll of the tube and a touch of the pincers as the molten blob at the end of the tube expands and stiffens. Spherical vessels are really very difficult to blow, and are usually plain and unadorned for use in the laboratory. Whatever the general shape of the decanter, jug, wine-glass, or beaker, it comes by its adornments through processes that are ridiculously simple—people usually grin when watching a skilled blower at work. He works at high speed and he works with all but mathematical precision; all but, for there is always the slight waywardness of human fallibility.

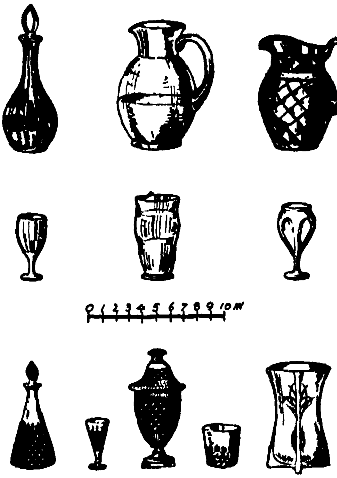


FIG. 82.

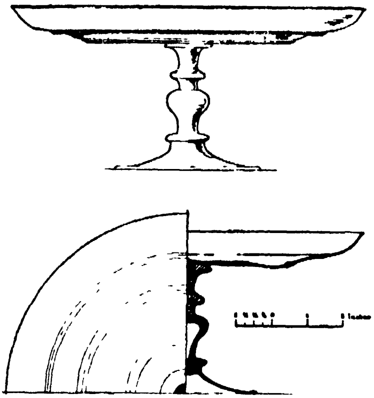


FIG. 83.

FIG. 82. Glass-ware.

FIG. 83. Venetian Glass Fruit-dish, *c.* 1510.

In crystal or cut glass, on the other hand, *mechanical* precision of form is of the essence of the thing. It is readily attainable by the technique involved, and if there is failure to attain it, the thing is spoiled. One may, if so minded, regard the crystals of nature, or the cut stones of the modern jeweller as the subject-matter, or *motif*, conventionalized in cut glass; but it is hardly necessary to seek an inspiration for the cutting outside the cutting itself. After all, rock crystal was used for costly vessels before clear glass was available; and the intrinsic qualities of that superb material—transparency and brilliance—were developed by cutting and polishing, long before 'stones' as we know them to-day came into use.

Given the material and the technique, cut glass explains itself. Derivation, as above defined, is here at work. When extraneous subject-matter can be recognized, there must be adaptation of no uncertain kind. In glass it cannot be otherwise.

Suppose a vase, or bowl, or decanter covered over with a reticulated pattern of grooves leaving lozenge facets between; that is not necessarily a decorative representation of a net, although vessels containing valuable liquids have been protected with netting of various kinds time out of mind. Then again, many a cut-glass lid handle, or stopper, bears a close resemblance to a thistle, though no one ever used thistles as stoppers, or handles. True, as the emblem of Scotland the flower has a certain pride of place on the top of a cut-glass whisky decanter, but the thistle stopper is wider in its range than bonny Scotland. The thistle has a faceted calyx and a group of petals with a distinctive profile; the petals that make up this group can readily be represented by grooves, and the top of the group by square facets. The only incentive for a great deal of natural *motif* used by the ornamentalist is not infrequently the accidental fact that a certain flower, or animal, *lends itself* readily to conventionalization in a given medium.

Where so obdurate and inelastic a medium as cut glass is involved, it is idle to seek very far beyond qualities inherent to the material, when subjected to a given process, for explanation of what the ornament is about.

7. *Readily Adaptable Natural Objects*

There are innumerable vegetable forms, particularly the small ones, and many organic and inorganic microscopic structures which are, so to speak, full of pattern based on symmetry with respect to one, or several axes, and on contrasting diversities of minor detail; these forms have movement, life, character, individuality—call it what you will—a power to interest us to the point where our response has a mood. Now, given a change in scale, such things often look like ready-made working drawings for metal-work, wood carving, stone cutting, or other ornamental trades. The designer or craftsman, when he seeks inspiration from such lowly things, is hardly on the same high poetical plane as when symbolizing the ineffable mysteries of a 'true faith' in recondite symbolism; but he is at least glorifying creation in a humble act of praise, even when he takes all the credit to himself for his inventiveness, rather than for his observation. After all, since the more advanced races have ceased to attribute moral virtues to all the beasts and flowers within their ken, there is not much point in relying solely on a body of natural decorative *motif* of which few besides the designer can appreciate the significance.

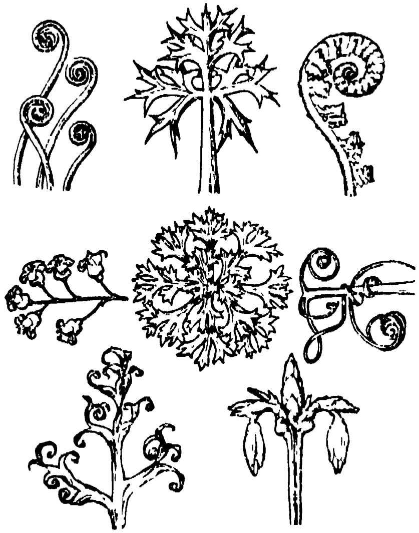


FIG. 84.

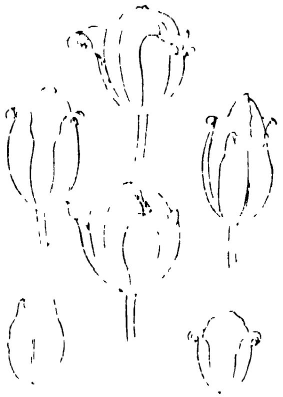


FIG. 85.

FIG. 84.

Shoots of American maidenhair-fern. Burgati's eryngo. Shield-fern opening. Black currant. Willkomm's saxifrage. Tendrils of pumpkin. Dry larkspur leaf. Bud, Japanese golden ball tree.

(After *Illustrated London News*, Aug 31, 1929.)

FIG. 85. Tulips.

The form of a petal at any stage is a graph of the forces at work.

In ancient Greece and in medieval Europe generally it was far otherwise, and natural objects in great profusion attached to the gods of Olympus and to the Saints in Paradise. The point here is that when the ornamentalist finds a natural object particularly adaptable to this or that technical process and medium he often uses it. Take the shell forms and convolutions of the Rococo, for example. No wood-carver who has once done that stuff (and nonsense) will ever with equal willingness carve any other sort of thing —it is so eminently carvable. The same might be said of the acanthus leaf as conventionalized in marble and the bulbous bossy crimpy-edged hawthorn and curly greens as translated to sandstone.

8. *Flowers in Wrought Iron*

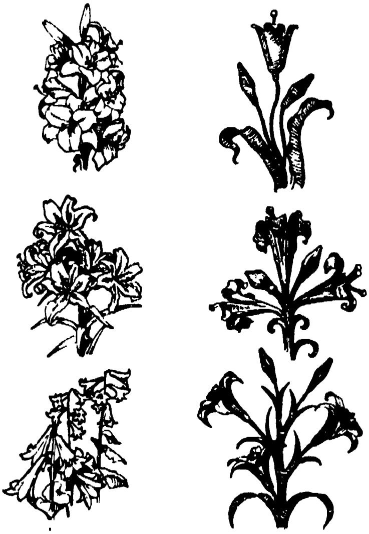


Fig. 86. Lilies made of organic cells under the impulse of evolutionary life; and lilies made of hammered iron by Mr. Sontheim, Montreal, and Mr. Heddon, Edinburgh.

But to continue after this digression and, disregarding the question of whether the wrought-iron lilies about to be considered occurred as symbols of virginal purity on a rood screen, or merely for fun on a balustrade, let us ponder the laws of their being. Distribution and pattern may have much to do with the liberties taken. On any stalk of real lilies, for instance, the lowest flowers come out first, the top buds being the last to open, and by the time they are out the lower ones are faded. The designer may, perhaps, ignore this particular characteristic while seizing greedily on some other one more compatible with filling the space at his disposal. He converts the lily into an ornament. If he just made the wrought-iron lily as like a real lily as he could—and he could make it very like—it would no longer have the character of wrought iron. He would have wasted much time and failed as ornamentalist. His flower must be a lily, let us say, but it must also be a composition of bar and sheet metal cut, welded, hammered, and bent in accordance with good smith's practice. It is made of fibrous iron, not of living cells, its system of growth and development is by laws other than those of botany.

9. *Beasts in Stone*

The stone beasts that squat on the balustrades of Notre-Dame, Paris, and of Laon Cathedral, solemnly overlooking a sea of roofs, and a widespread country-side, are well worth some attention. Those at Paris, which are restorations, constitute a 'bestiary', a collection of created things, each endowed with his significance—the devil included. Those at Laon nearly all represent oxen. Getting the stone up the hill and then up to the wall-heads brought much suffering and heavy labour to these patient beasts; as they died to the glory of God, their sacrifice was thus recorded. But all this is by the way; the question of why they are there is not the issue here. What claims inquiry is wherein they are bears, or pelicans, or oxen, and at the same time stones and ornaments—how has the blood been petrified in their veins?

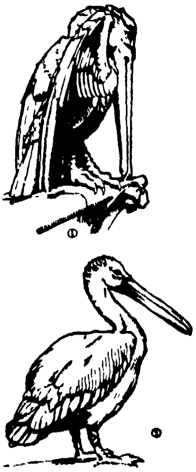


Fig. 87.

1. The Pelican at Notre Dame.
2. A Pelican in St. James's Park.

Each and every one of them has all the salient characteristics of his kind, but in somewhat exaggerated degree. If they were merely faithful models they would not 'read', set up there aloft where they are, for one thing. Real stuffed animals in their places would only appear as bunches of fur or feathers. Then again, if proportionate in all their parts many of them would have perished in the making, for stone is heavier and more brittle stuff than flesh and blood and bone. And further, had they not been massively simplified, especially with respect to their protective backs, the weather would have destroyed them far sooner than it did. The French Gothic building art of the period to which they belong is remarkable, above that of any other time or place, for its weathering qualities, always contriving gracefully and ingeniously to shed the wash of rain from walls and copes and pinnacles and arches. So these beasts are, in a sense, little monolithic buildings protecting themselves by their very poses from Jupiter Pluvius.

And now to deal in detail with a single example—let us contemplate the pelican at Notre-Dame. From far away she is unmistakable for any other bird, and nearby she is found to be all pelicanhood personified. She differs in no respect whatever from a real pelican through bad drawing or lack of observation—where she differs at all her differences are intentional. They involve a general simplification accompanied by exaggeration of all that makes a pelican—the grouping of the feathers in the wings and tail, their pattern on back and breast and crest, the scaly tissues of the legs and claws, the glorious bill, and best of all that wise old eye peering sardonically from its splendid socket. If there is a hint of caricature, the caricaturist was a kindly one with deep insight and understanding; and he knew his stone and his tools as well as he knew his bird. The thing is on an altogether different plane from so many modern attempts at the grotesque in decorative sculpture, where sheer bad drawing and lack of observation are put forward with a blatant claim to imaginative power, a sense of humour, and—of all things—originality! It happens to be the work of a mid-nineteenth-century Frenchman, on restoration bent, and is as good as anything of the kind ever done.

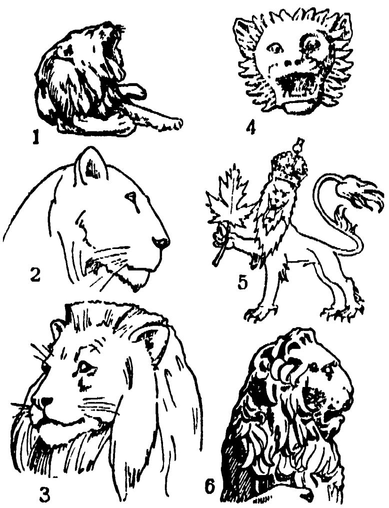


Fig. 88. Lions in Nature and in Art.

1. Lion yawning.
2. Lioness.
3. An old lion.
4. Greek terra-cotta spout.
5. Embroidered crest.
6. The Marzocco, Florence.

10. *Variations in Decorative Lions*

The lion has probably been the subject of decorative conventionalization to a greater extent than any other beast, and, without labouring the point of whether he was materialized in terra-cotta, or marble, or bronze, or embroidery, let us glance at some of his characteristics—the open mouth with wrinkled lips, bared teeth, and iris-petal tongue—the deep-set triangular eye—the rounded ears—the mane with crest erect and hanging side-whiskers—the hirsute adornments of the legs in certain breeds—the well-armed toes—and last, the whipping tassel-ended tail. Different decorative artists, breathing the spirits of different ages, have seized upon some or other of these characteristics for special emphasis, and in so doing have betrayed what interested them most about the noble beast—his moods of bored dignity or his spasms of raging temper. So the Greek waterspout glares open-eyed and open-mouthed, the crowned heraldic crest holds high his head in pride and whips his tail, while the Marzocco of Donatello guards the lily shield of Florence with benign patience through the centuries.

11. *Gothic Heads*

In conclusion, attention may be given to the heads of decorative figures from Gothic buildings. The breadth of treatment in the hair masses is all to the good from the point of view of design, considering the circumstances of position in relation to the vast surfaces of masonry and the forcibly moulded members of arches. Characterization is attained with astounding economy of effort. The 'bankered' surface of the block is touched at many points and curls or locks or straight tresses are achieved by means of crisp patternings. The hair of heads or beards may be conventionalized to the point where it becomes the trick-work of masons' tools, yet it never loses its character. The beholder knows just what kind of hair is meant; so did the sculptor concerned.

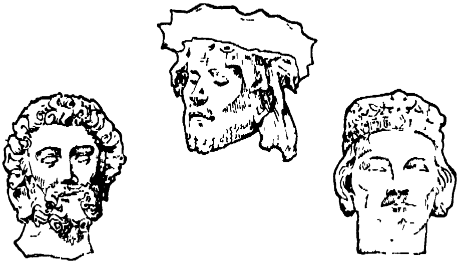


FIG. 89. Heads in decorative sculpture.

Apostle, Hospital of St. Jacques, Paris, 1320.
Ecce Homo, Beauvais, 1475.
Phillip III of France, Abbey of St. Denis, 1307.

A word on 'bankering'. When a mason or stone-carver sets about reducing his block he does so by means of very simple forms—cubes and drums for the most part. If he just goes gradually in from the rough block he is sure to lose his way—as Michelangelo in his haste sometimes did. Whether it is a question of a head of Christ, or a Corinthian capital, the method is the same. This leads, in effect, to a broad analysis of the main masses in the very process of production. This analysis can be preserved and maintained by leaving the bankered face of the block wherever possible. In long range this geometrical simplification of the masses is far more expressive of character in the subject-matter than any full elaboration of form could ever be.

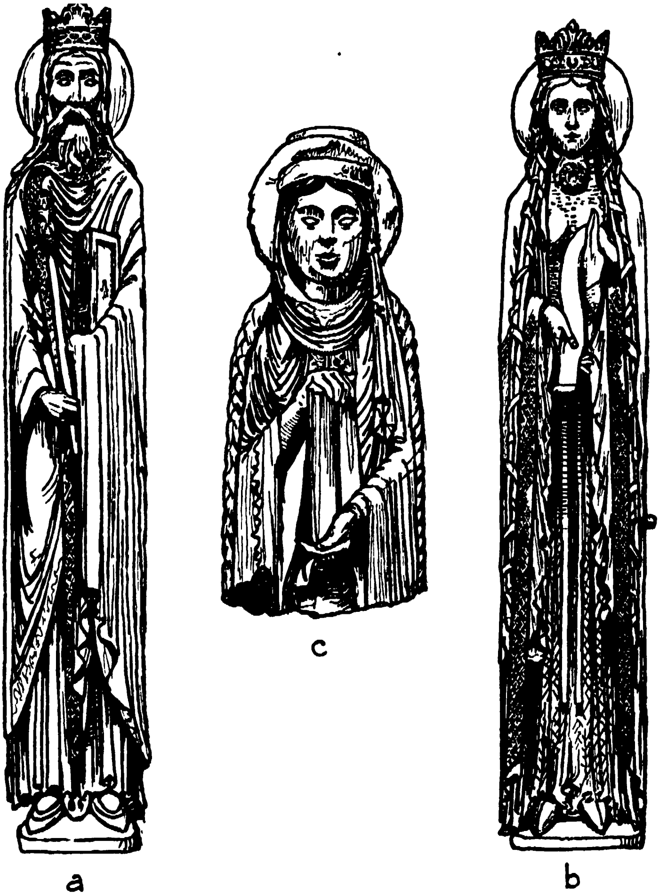


FIG. 90. Decorative Figure Sculpture, mid twelfth century, French. *a* and *b*. From Notre Dame de Corbeil. *c*. From west front, Chartres.

The decorative sculptor who knows his business makes sparing use of telling detail, leaving the broader masses distinctly felt. In this artifice the figure sculptors engaged in the decoration of the medieval churches of north-western Europe have never been surpassed. The Egyptian, the Greek, and the Italian decorative sculpture has other qualities, but here the Gothic art was supreme. Impressionism was well understood in England six centuries before Victorian painters ever thought of it.

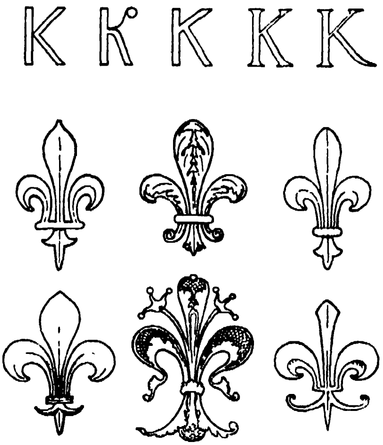


FIG. 91. Each of these six fleurs-de-lys has its own mood; so with each of the five Ks—moods associated with pose and movement in other things.

XIV

THE PLACING OF ORNAMENT

1. *Use, Structure, and Ornament*

THE disposition of ornament is a matter of plain common sense. One does little more than state the obvious in saying that ornament must not interfere with use; that it should not outrage structure; that it may, with advantage to itself, claim positions where it is protected from wear, tear, dust, dirt, and damage from rain, snow, and frost; and that, unless the incidence of light and shade is such that it is adequately revealed to the beholder, ornamentation is a waste of time and energy. Yet how common it is to find ornament misplaced in several of these respects.

On the one hand there is the thing to be ornamented, with a form broadly determined by use and affected in minor ways by structure —that is to say by the function of the thing as a whole and by the functions of its parts as structural elements. On the other hand there are the many categories of ornament, from geometric patterning to idealistic sculpture. The placing of ornament is thus a double-sided affair. There is the kind and quality of the ornament and there is the form and size of the object ornamented; both have to be taken into account; there is infinite variety in ornament and there is infinite variety in the form of objects.

It sometimes happens that the main function of the thing is to carry the ornament, though this is rare; but the placing of ornament is usually something that has to be considered after the form of the thing to be ornamented has been fully, or almost fully, determined. When available positions have thus come into existence the range for choice and selection of ornament becomes limited.

Now a designed object may be a complete expression of purpose, of structure, and of mood—a perfect work of art, without any ornament at all. In that case the need of ornament does not arise. Or again, the object may have no compatible need of significant ornament, and some modulation of structural members (architectural treatment) may be all that either head or heart can demand.

As most objects of use have several parts and are in this sense organic, these parts may be functionally distinguished as of two main classes, working parts and resting parts. Thus columns, piers, beams, arches, legs, stretchers, frames, feet, handles, and generally speaking members carrying stresses arising otherwise than from their own weight may be regarded as working, while curtain walls, tympana, table-tops, chair seats, roofs (sometimes), and lids may be considered as resting parts; that is to say at rest with regard to the structure, although not necessarily doing nothing. The modifications of working parts should not, as a general rule, be so placed as to appear to contradict the facts of the case as to the nature of the work they do. If exposed to wear and tear of any particular kind, elaborations should be so placed as not to render the members elaborated less serviceable, or less durable.

2. *Chairs*

The feet of chair and table legs are cases in point; they should neither suffer from occasional contact with booted toes nor have edges, or angles, that will impinge upon a sitter's ankles. The head of a chair leg, on the other hand, may reasonably be modulated without suffering itself, or causing damage. The arms of a chair to be of any use should be comfortable, and that means smooth and rightly placed as to their height; but the support under the arm may well be decoratively modified so long as its function is not contradicted or interfered with. The extensions, above the seat, of the back legs may be required for grasping in the hands when moving the chair as well as to form part of a framing to carry the back-board itself; and any elaboration of form should be achieved with a due regard to this. The top of the frame of the back is a safe place for such elaboration as will respect its dual functions in keeping the tops of the extended back legs apart and in taking the top of the back-board, if any. This latter member may be made the object of considerable elaboration, so long as this is done with due regard to the spine of the occupant of the chair. Although functionally of prime importance, so far as structure goes, the seat and the back-board are resting members. They do not contain, or transmit, concentrated stresses such as occur in the legs, arms, stretchers, and back frame.

A glance at any series of chairs arranged in chronological order in a museum shows a gradual tendency, with the increase of technical skill, to treat the frame as a single element, with concealed or invisible joints. In the earlier examples the function of each member

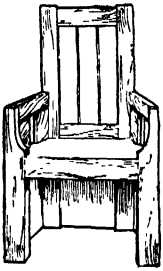
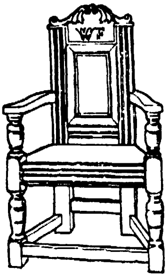


Fig. 92.



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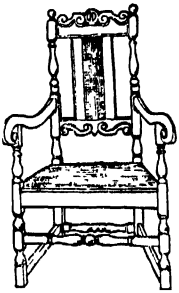
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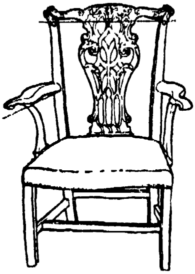
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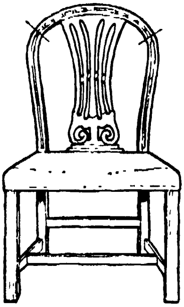
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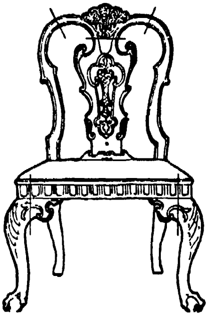
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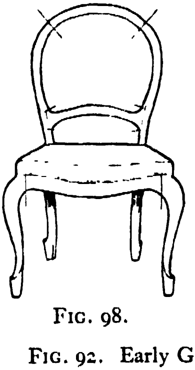
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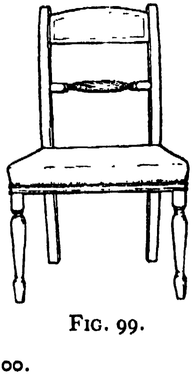
Fig. 99.

Fig. 92. Early Gothic chair, *c.* 1300.
Fig. 93. Chair, Bishop's Palace, St. Andrews, 1612.
Fig. 94. Jacobean chair.
Fig. 95. Chippendale chair.
Fig. 96. Heppelwhite chair.
Fig. 97. William and Mary chair with exposed feet.
Fig. 98. Second Empire chair.
Fig. 99. Early Victorian chair.
(Note position of the joints in the frames.)

of the frame is gloried in and emphasized. It is as if the earlier chair-makers made their chairs say: 'Look! this is how I am made', while the later chairs are made to say: 'Look! this is what I do; but never mind how I do it. Your business is to sit on me and find out how comfortable I am. How I am put together is my secret.' Needless to say, the earlier chairs hold together better. While the later chairs are usually so mysteriously tactful, yet in some late types there is no concealment of joints, these being so contrived that when they open, as they must, the opening is well masked.

3. *Members and Joints*

The handles of vases, jugs, and teapots, whether of china, glass, or silver, are well worthy of some attention. The functional part of the handle has to be in just the right place for balance both when holding and when tilting the vessel to discharge its contents; it must also afford a good grip with comfort. It is extraordinary how many freak designs for teapots are perpetrated (that is, made, sold, used, dropped, and broken, or put in a cupboard as useless) in which the spout, handle, top, and lid are out of relation. This is a question of the design of the object, not of the decoration of the handle. Before considering the placing of decoration on teapots one should be in a position to imagine a proper vessel with a proper handle. How is this to be put on? Usually with some amount of material extra both to the handle and to the container—solder, rivets, china-clay, or glass. The structure of the joint itself may offer opportunity for prominent treatment; or the joint may be concealed, or masked, by some conventional vegetation of the kind that Robbie Burns would call 'whirligigums and whigmaleeries'.

The marking of the transition points of the structure (the ends, that is to say, of the several members), the fluting, or moulding of members in the direction of their stresses and like devices, which tend to show what is going on in the fabric and to define and differentiate one member from another, are all of common occurrence. It not infrequently happens, both in the major design of buildings and in the minor design of furniture, fittings, and utensils generally, that what were originally strictly structural modifications become, so to speak, their own subject-matter and then, with wills of their own, proceed to transgress the actual limits of structural members. Thus a very dependent form often attains to a state of semi-independence—an abstract existence. The jointing of masonry and cabinet work then becomes a matter of accommodating, for the moment, not some structural member but some abstract form.

The rustication, for example, on the walls of the Madeleine in Paris is out of all relation to the actual joints of the masonry of which the wall is constructed. It is an ornamental surface pattern resorted to to give a particular scale to the fabric. The mason joint, so usual in medieval masonry and so indispensable in cabinet work, enables such abstract members to die on one another, return on themselves, and perform other gymnastic feats.

Those conventional and more than half decorative members—architraves, friezes, and cornices—are frequently to be found all worked together on a single course; they usually occur in a more natural materialization in three courses related to the members in a practical way; but when the scale of the architecture exceeds that of the masonry in order of magnitude, they may occupy many courses.

The furniture design of the eighteenth and nineteenth centuries is impregnated with a respect for the abstract member to the disregard of the structural member.

4. *The Architectonic*

Now many of those well qualified to speak take the view that abstract form is what architecture has to deal with—that architecture, as a fine art, begins when design concerns itself with abstractions of form, regardless of origins and use and with only so much respect for normal construction as is essential for their embodiment. It is well to realize this view of the matter with all its implications. The reader may be reminded, however, that it is DESIGN that is under consideration—a mode of expression of infinitely greater range than architecture, however understood.

The placing of those modifications of structural members, which normally clarify structure, but confuse it when they themselves become too interesting, being now disposed of, the placing of significant ornament claims attention.

The amount of extraneous ornament which a duly designed object can carry without loss of character is strictly limited; so also is the amount of ornament that can be present in a given case without defeating its own very interesting ends. A scheme of decoration usually involves ornament of different kinds. These have to be related in scale and marshalled as well as placed. Otherwise there will be loss of effect and confusion.

What are the kinds of places appropriate for the kinds of ornament—sculpture, pattern, and all between? Without surrendering the position taken that it is use and structure that determine the amount and the placing of ornament, and even the kind, it will be more convenient to review the several broad categories to which ornament can be assigned and consider the kinds of places appropriate to each. It is not, after all, very difficult to distribute all ornament into a few broad classes, while the kinds of objects are innumerable and the variety of their structural organization is infinite. It will also be convenient to begin at the top, so to speak, with ornament and decoration of the highest order and descend towards the less significant and more mechanical, remembering that good taste in such matters is not a hunger for the higher as against the lower, but a sensitiveness for the apt.

5. *Individual Figures*

Sculpture in the round, when employed in the adornment of structures, great and small, has an importance based on its interest, significance, and, to some degree, on its cost. Sculpture so used is a very different thing from sculpture independent and free; for, if it is to have any value as ornament, sculpture must be related to all nearby parts of the structure it adorns, and often to the structure as a whole as well, in scale, form, and 'movement'.

The single figure has two possible positions. Surmounting a dome, or spire, or flèche, it cuts the sky in silhouette and relates as much to the structure as a whole as to the finial element of which it becomes a part. Its other position is in a carefully prepared place where adjoining and surrounding elements are devised in strict subordination. So placed, the figure is the focus of an attention almost all its own. It must, nevertheless, be conceived, particularly in the matter of scale, with reference to the larger elements of the composition of which it is a part. The St. George in London and the S. Giorgio in Florence are cases in point.

The set of independent figures demands a set of positions very analogous to those of the single dominant figure—against the sky, as on the balustrade of St. Peter's; or in a series of prepared places. These are generally either near the eye, as in the portals of Gothic churches, or near the wall head. In such lofty positions the sculpture cannot be appreciated in detail by a beholder on the ground. It is enough to know that the kings of France stand ranged up there across the façade of Notre-Dame in Paris; or that a winged heavenly host stands sentinel in the pinnacles of Rheims. Subject and position can thus reinforce one another's arguments—a line of kings, an encircling host of angels.

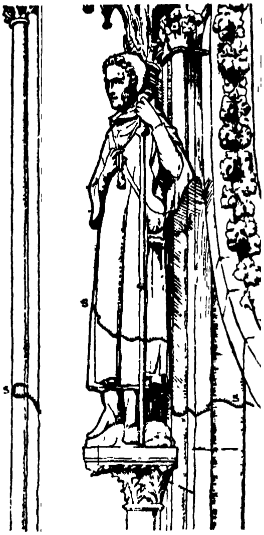

Fig. 100.

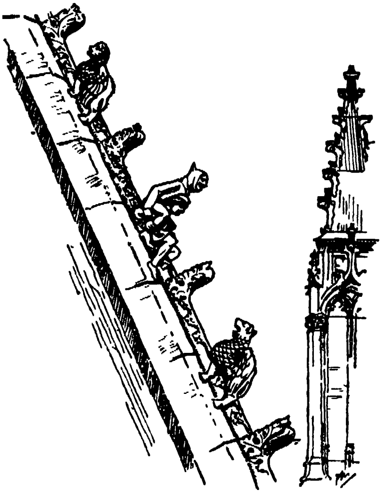

Fig. 101.

Fig. 100. David, W. Front, Rheims. The finest decorative figure extant. It grows out of the fabric. (Note analogy between drapery and mouldings and between hair and foliage.)

Fig. 101. N. Transept Skew, Rheims. (Note maintenance of scale with variation in size of crockets.)

6. *Theme Groups*

Very different is the position which the theme group demands. Too high, it will not 'read' and becomes mere confusion; too low, it absorbs interest to the detriment of the structure; unenclosed, it lacks protection, which is a practical matter where intricacy of form has to be reckoned with, and is besides all too apt to lack that dramatic force which a frame gives by detaching surroundings. Ranged against a wall and enclosed within a pediment, the presentation of something going on, in which a number of persons are taking part, becomes at once worth while in itself and possible as an adornment. The birth of Athena at the Parthenon, the crowning of the Virgin at Rheims, and the Christ in Glory at Lincoln (where the central figure is practically in the round, while the subordinate figures are in high relief), are all cases of important themes in important sculpture set in positions which are not only architecturally important, but significant in the loftiest sense.

7. *Histories*

'Histories', to use a good fifteenth-century designation for such things, are in their subject-matter not essentially different from the sculpture groups just considered, but they deal with matters of less importance and are in relief rather than in the round. Their decorative value is largely dependent on the fact that they occur on friezes, in panels, or in medallions and, however interesting in themselves when viewed close, their decorative value is often that of the spot of interest or the enriched surface. The 'history' as far as subject goes may be about anything or about almost nothing—the sacrifice of Isaac, the Battle of the Spear, singing boys; but it is always in treatment subordinate to the architecture. This is not to be understood as 'a rule of art' but as an explanation of a technical term. The isolated 'history' is of frequent occurrence and a place can often be found for it if wanted; but it is when a series of histories occur, as in the metopes of the Parthenon or the panels of the Baptistery gates at Florence, that their quality as ornament is best worth exploiting.

8. *Trophies*

One may consider as in one group of *motif* such various things as coats of arms, shields, achievements, cartouches, medallions, trophies of weapons or instruments, and the like. The origin of such things is the quite natural habit so many of us evince when nailing a thing up on the wall when we are done with it, instead of destroying it. When this is done in a ceremonial spirit it leads naturally to the perpetuation of the things hung up—skulls, wreaths, weapons—by integration with the structure in paint or carving. The place for such things still remains somewhere free from wear and tear, out of the way, yet where they are readily noticeable; it is also likely to be, other things being equal, and no specific reason to the contrary, in the middle of some element or part, be it pier, or bay, or curtain wall, or gable, or lunette, or panel. The spot of ornament arising in this way may by its very location at the hands of a skilful designer achieve purposes far other than the display of its subject-matter from a point of vantage. The sense of scale of a piece of masonry may be enormously helped by a little bit of fortuitous detail of sufficient interest to attract and hold the wandering eye. A vast plain surface can become vaster and plainer by the judicious placing of a medallion, nor, by the same means, is it impossible to produce the reverse effect. But composition is not here under consideration and need only be referred to just now with reference to these rather vagrant trophy decorations which are of all classes of ornament the least tied down as to position.

Now what one might do with a full-sized shield on a small building, one can do with a trophy of giant's arms on a large building, or with a small-sized medallion on a box-cover or bookbinding.

9. *Garlands*

Garlands, festoons, swags, wreaths, and such-like floral decorations originated much as did the trophies. On festal occasions the primitive shrine was gay with garlands: these faded, and were replaced by decorative representations. They cling by associations and for practical considerations to the old positions; outside, to the frieze, protected by the eaves, and inside, to the roof beams easily identifiable with the ceiling. A wreath on a wall is a panel frame of sorts, and a panel frame may readily become a wreath of sorts.

It is always incongruous to employ decorative flowers in paint, mosaic, plaster, wood, stone, or metal with entire disregard for the fact that the charm of flowers is largely due to their transience and their fragility. Wreaths of roses carved in wood may have their place at the head of an overmantel panel; but wreaths of roses, even in cast iron, have surely no proper place on a fire grate.

10. *Foliage*

One may distinguish sharply between leaves and flowers made up into groups in wreaths and swags, and leaves and flowers occurring for their own sweet sakes and not as aggregations. It is, of course, leaves and flowers in their ornamental immortality that are meant. Where may they be placed when they clamour for admission into the thing as a whole that the designer is contriving?

The Corinthian capital is full of quaint conceits in all its manifestations—Egyptian, Greek, Roman, Byzantine, Romanesque, Gothic, and Italian throw-back, father to the later French and English breeds. The whole thing began apparently by festively pretending that dead posts were live palm trees and attaching fronds to their tops. The still quainter conceit of making the top of the post into a lotus flower, or bud, died of its own monstrosity and need not disturb us. The fundamental idea of vegetation attached pointing upwards from the head of the shaft has commended itself to so many generations of designers and building owners that there is no need to question its propriety. If vegetable forms are to be introduced at all, the capital is a good place and this a good way to do so.

The custom survived to a certain point in the earlier phases of Gothic art when an interest arose in the decorative possibilities of many kinds of vegetation that did not lend themselves readily to the pretence of being tied on pointing up, but found no difficulty in the simulations of a lateral trend. The foliage of capitals in Western art does not seriously simulate something growing off, or on, or out of the shaft, as off a stem, but rather something attached, in festal or frivolous mood, to the top of a post. If there is no occasion for such frivolity, one may well leave the vegetation off and be content with the functional neck, bell, and abacus unadorned.

Another class of foliage ornament, usually in low relief, or painted on, is spoken of as 'running', whether there is an actual repeat or a continuous variation. The origins of such arrangements of floral forms were probably in embroidered bands and trimmings, and in the continuous patternings that arise so easily in the decoration of pottery. In architecture its place (if anywhere) is in short friezes and vertical pilaster panels. When the alternating spirals of such decorative vegetation are inhabited by animals, persons, insignia, or incidents there is more excuse for their suave pertinacity.

Repeating floral and foliage patterns constitute the staples of the ornamentalist's trade. It is easy to argue their vanity and inanity. But it is not easy for the designer to do without them in a world habituated to their presence wherever things made have ornament at all. For all their frivolity they have some serious uses.

An anthemion repeating pattern gives measure by its rhythmic beat to a long continuous corona, so enriched. A pierced Gothic cresting modulizes the intricacies of the screen work below it in the same way. A water-leaf, an acanthus leaf-about-pattern, or the ubiquitous egg and dart, a variant of the same, gives definition and interest to a moulding whose section—ovolo or ogee—corresponds to the outline of the leaf. How far a particular moulding had been determined and placed to carry the leaf, or the leaf selected to enrich the moulding, might be hard to determine in any given case. Mouldings come about irrespective of vegetal enrichments; and it is preferable to find the place for a particular enrichment on a particular moulding than to regard the enriched moulding as an indivisible entity.

11. *Bands*

In the arts of design the horizontal band, stripe, or belt usually has its origin in structure. The belt course in masonry and the belt in dress have much in common. The differentiation of such important minor members from the less active major elements (wall-face or skirt) adjoining them makes for clarity. So the minor members receive their enrichments. These are of many origins, all interesting to pursue; but these origins have little or nothing to do with the placing once the origins are forgotten. A close repeat is the main consideration; key pattern, fret, guilloche, wave, it matters little what the *motif* so long as the member with the special function is adequately distinguished. It is here no longer a case of finding a place for the ornament, but one of finding an ornament for the place. Of course the belt in building, as in dress, can be given due emphasis in many other ways than by patterning it over, but this is at least a good way, often the best way, and sometimes the only way.

Buildings have been used in the exposition of the problem of placing ornament; but it should not be inferred that the principles are any different in the cases of dress, furniture, utensils, and the rest of the apparatus of life. True, an ornament consisting of an adequate presentation of 'the birth of knowledge' can hardly be conceived as finding a place anywhere but upon a building of supreme importance, but 'histories', trophies, garlands, foliage, and band patterns may find their places to add their interests in all and any sorts of things.

Part III

SOLUTION OF PROBLEMS

XV

FUNCTION AND FORM

1. *Dress*

IT may be some relief at this point to leave architecture alone, and illustrate the discussion of one fundamental aspect of the problem of design by means of examples from the lesser arts. Let us then consider a few of the things that make up the apparatus of life—things of the kind that most people know something about; and on which we all very readily pass our judgements of approval, or distaste. In doing so let us restrict our attention to their more austere aspects, leaving out of consideration all questions of how they are or should be ornamented. But in so far as most objects in the classes under consideration are ornamented, often profusely, one perfect example of design and structure, lovingly elaborated with an incrustation of delicately executed decorations, will receive attention at the close of this chapter.

Turning first to the subject of dress and viewing it in the light of what has been said above with respect to form and fashion, it should be possible to arrive at some fairly definite ideas as to what is right and what is wrong. Dress, like houses and furniture, is an essential of well-being. When taken together with such matters as the arrangement of the hair and restricted in its application to the adolescent and adult females of our species, the Teutonic mind does not hesitate to regard it as a fine art, and to give that art a name, 'Frauenkunst'. It is not necessary to develop separate theories for 'Menchenkunst' and 'Kinderkunst', and one may well be content to embrace the whole subject of clothes under the designation—dress.

What of the purpose of dress? Ethnologists have brought a good deal of evidence together to show that adornment was the primary intention and protection against the weather a decidedly secondary one, at the beginning. It may be remarked, however, that neither Esquimaux nor desert Arabs could last a season without their substantial, or voluminous clothing. Of course, one may argue that man never penetrated to the uncomfortable places till he had learned, through beads and feathers, to extend a protective covering over most of his person. In any case, it will be admitted that the skins of animals were used for comfort in very early times—long before vegetable fibre was woven—and that throughout historic times clothing has had its utilitarian functions directed against the weather and the enemy. A subsidiary purpose may always have been, and certainly now is, the concealment of the body, or at least parts of the body, in the interests of good order and decency. Yet there is much to be said for the theory that clothing created modesty in the various degrees in which we encounter it, and that modesty did not originally stimulate the production of either underclothes, or overclothes.

2. *Apparel*

Leaving origins aside, it will be more useful to ask what are clothes worn for to-day? Tiaras, bracelets, necklaces, and jewels generally, which are ornaments applied to people, rather than to the clothes people wear, are not under review. The concern is in the structure and shaping of real clothes, without asking whether they be fashioned to keep us warm or to keep us cool; to conceal our bodies lest their allurement cause inconvenience, or lest their flabby decrepitude put their owners to shame; or whether they be fashioned, as is so often the case, with erotic or even aphrodisiac intent. It is unnecessary to say anything more of the purpose of dress beyond remarking that there is an inevitable subsidiary object in its design and that is to fit dimensionally the person wearing it; and fitting does not only mean enclosing the wearer, but allowing comfortably for such movement as may be expected. Clothes for sports, for different kinds of dancing, for military service, for rough labour, for sedentary occupations, and for ceremonial purposes are all necessarily modified both with respect to the wearer and to the circumstances in which they are worn. When these matters are borne in mind one becomes readily sensitive to the ridiculous, which so often manifests itself in obedience to what is called 'the dictate of fashion'—of which more anon.

The question of choice of colour with respect to complexion, eyes, and hair, has been touched upon in the discussion of colour and need not be further enlarged upon here. Two other aspects of the question of colour in clothes require attention, however.

In strong enough light, out of doors, there is no limit to the degree of saturation which may be indulged in, or to the combinations of crude colour that may be risked, provided always that the gaiety of the occasion is consonant with such exuberance of display. In dull light, however, a little strength of colour goes a long way; while under artificial light the colour of the light must be taken into account.

But apart from the mood of the occasion there is that far more subtle thing, the mood of the wearer, to be considered—the lady, for example, who is, and knows she is, an evening thunder-cloud, the girl who breathes the very spirit of dancing waves at dawn, and other such-like human fantasies. Now, could anything be more inane than to enwrap these diverse creatures, last year in some fashionable broken tone, this year in some fashionable saturated hue of blue or green, and next year in some fashionable tint of magenta or orange; all because of a conspiracy of weavers, dyers, and couturiers; and all regardless of the spirit of the occasion, and of the wearer's transient or habitual mood, to say nothing of the colour of her skin, eyes, and hair, and the sunshine she pervades.

Now what of the shaping of garments, for colour is a side issue? There is as much difference between a Greek, draped, uncut square-piece garment and a constructed coat or skirt, as there is between the mast of a junk, made to be let down in a typhoon, and that of a schooner depending on standing rigging to keep it up in any gale that blows. Both kinds of mast are very good, but there is little room for compromise designs. The Greeks—and of course we mean the Greeks of Ancient Athens and Aegina, and Olympia, and Corinth—attached their garments with a few studs and a well-placed girdle or two; and the well dressed among them took an infinite lot of trouble to keep neatly draped. The question of fit was just a matter of length and width and the question of cutting for freedom of movement did not arise at all. For active pursuits such garments stopped above the knee; for lounging in the shade they extended to the heels.

Now, when the Parisian designers of ladies' dresses run short of ideas, as happens now and again, to fall a prey to a retrospective tendency touched with Hellenism, they make their victims ridiculous with garments partly cut, and partly draped and kept neat not by the incessant ministrations of attendants, but by stitchings that destroy the very flow of movement in fabric which is the essence of drapery. Such designs are simply incongruous. This phenomenon appears to run in a sixteen-year cycle. At intermediate times, however, we are occasionally inveigled into something like a return to the feminine upholstery of mid-Victorian times. That phenomenon had one artistic virtue at least—it had a certain weird consistency.

The trouble with the fashion makers is that they won't leave well alone where it is well, in women's attire, and make change, not for the sake of change, but in the direction of positive improvement and specialization; as the designers of racing yachts and motor-cars do. No sooner have the ladies of the civilized world got themselves covered in more or less rational ways (as they did with the help of the designers of 1907) that only needs time and insight for the promotion of an evolutionary development into a respectable system, reflecting the spirit of its age, than a bevy of young women are suborned to attend the races at Auteuil, resplendent in irrational experiments, and the evolutionary process is arbitrarily upset. Then the dear creatures all over the world, avid for novelty and uncritical of design, tumble over each other in their hurry to acquire big hats or little ones, long skirts or short ones, straight lines or reticulations, regardless of grace, comfort, and personal idiosyncrasy. That the whole thing is a gross commercial imposition never occurs to them.

This entire annual farce (now reinforced by quarterly experimentations) is ultimately founded on snobbishness—the unintelligent aping of one's betters, be they duchesses or courtesans. In the eighteenth century, the great dames set the fashions, and did so with superb *élan*. As things moved more slowly then, they had time enough to think out future confections over against the later day when the parsons' and the doctors' wives would have moulted into a semblance of their plumage of the moment. The great dames of our own time are too busy to do their own thinking; the wise among them use discrimination in their patronage of designers, but most of them are quite content to follow the young women at Auteuil.

Now and again they do get something very well worth while from that source. Lady Dilke in the nineties, and Irene Castle in the teens of the present century, dressed to perfection, and contrived it themselves, but they were exceptions.

The situation with regard to women's apparel may be summarized thus. On the one side you have production—a few great designers, a lot of professed designers who do not quite know what design is, and the mass producers, whose interest in the matter involves propagation of the theory that novelty and progress are synonymous terms. On the other side we have a clientele (in Western civilization at least) readily accepting this propaganda; and, in consequence, regrettably blind to the virtue of structure as the foundation for elaboration, no matter how whimsical and frivolous. Far be it from me to decry either whimsicality or frivolity in this art. Being an art of design it demands a structural basis for its whimsies.

3. *Coats*

In men's coats and jackets, on the contrary, we have the phenomenon of evolution in design at its steadiest. For fifty years, with the exception of a few military aberrations such as the shell jacket, five types, all closely related, have prevailed in western Europe and the English-speaking world. Incidentally, throughout that period the tailors of London have been the arbiters; and they are a conservative community among whom the expressive phrase, 'strange to the eye', is applied to any unauthorized innovation or sudden departure from the orthodox. Now these gentlemen have a preternatural sense of construction and an uncanny gift, in which they take great pride, for the cutting of cloth so that two things may be accomplished—the illusion of a snug fit, and just the right amount of slack for full articulation of the joints. The most difficult part of a coat to cut and fit is over an area of twelve square inches behind each shoulder. Sometimes sleeves, like trousers, are cut closer, for two or three years, and sometimes fuller. So, too, the neck opening may be higher and the lapels shorter for a time, only to lower and lengthen again within reason; and so in all particulars. The evolution of the five types, the sack coat, the cutaway, the frock, the dress tail-coat, and the military tunic, seems complete. Innovation has long restricted itself to the fortuitous placing of buttons in new positions where they can never be used, while strangely maintaining hip buttons just where they were a century ago when people still had holes in their coat-tails wherewith to loop them up for riding. Another survival may be noted in the cuffs of an officer's tunic which have long ceased to turn up, or button up, but are now separately made and sewn in their place and often adorned with dummy buttons and dummy buttonholes. Excellent examples these, of the procedure of evolution and the gradual process of discarding obsolete organs. Thus, once essential parts of the fundamental form survive, as expressional or artistic commentary thereon, ultimately becoming associational symbols. Hip buttons on formal attire are marks of gentility. So long as they are used in this way their location must remain constant. Nothing can be said for the present placing of front buttons on a dress-coat. Much might be said for leaving them off, as they imply nothing placed as they now are. But it is at the collar and lapels that the logical constructive sense of the London tailor shines brightest, in contrast with the insincerities of the French couturier when he decrees such structural adornment in the neighbourhood of the female neck. For there is only one logical way to make this part of a coat or jacket, whether tails be long, short, wide, or narrow, sleeves skimp or generous, waistline marked or ignored, and it is this: however open or closed the front, when worn with the collar up the lapels must close neatly the one over the other, and with the cuts just where they will allow the collar to stand clear of the lapels, as if the coat were habitually worn so. And this is a most sound tradition, now become a wise convention, for it respects the meaning of the whole sensible structure. Only in roll-collar evening clothes is this not so. But then they are intended for use indoors, while in almost any other form of coat an Englishman wears, he must expect to be caught out in the rain, and have to put his collar up sooner or later.

Another delightful surviving convention may be noted. How many know why any lady's garment buttoning down the front has, or should have, its buttonholes on the right, and its buttons on the left, while with the gentleman it is vice versa? Well, the reason is based on the delicacy of a former age when ladies and gentlemen rode together on horses, instead of sitting together in motor-cars. The lady rode on the left of the gentleman, leaving his right arm free to defend her, just as she still goes in to a formal party on his left to-day, and a certain privacy in buttoning and unbuttoning was deemed decorous.

The design of coats has thus been in a state of pronounced evolutionary stagnation for half a century and of slow evolution for a previous century, and there is nothing wrong with that. It is certainly no reason for complaint of want of originality in man's attire. For originality is of itself no virtue in design, but is only to be commended when justified by change in function, in material, or in construction.

Those who evince appreciation of the tradition in design so manifest in English tailoring during the last hundred years are sometimes confronted with the remark: 'But look at the statues of your politicians.' The reply I would offer is: Many good politicians had bad tailors, and very many sculptors, for a century past, have been singularly inept in handling accessories.

4. *Armour*

The evolution of protective clothing, or armour, was of course brought to a practical conclusion by the introduction of explosives, with the gun as an instrument for the propulsion of missiles that could pierce armour, doing far less harm to a man dressed in cloth than to one dressed in tempered iron. But as long as swords, spears, arrows, and rocks remained the offensive weapons, the evolution of protective clothing was conditioned firstly, by improvements in the weapons, secondly by improvements in the material, and thirdly by improvements in technical process, and in the technical skill available in the production. Thus it would be interesting, but, since well-arranged museum collections of arms are available for inspection, quite unnecessary, to labour the point and cite as examples all the exquisite forms of metal head-gear, beginning with those in evidence at the siege of Troy, and ending with firemen's helmets and fencers' masks.

5. *Swords*

In discoursing on the design of clothes, attention has been concentrated on jackets and, by way of reviewing the fundamental processes of design as applied to weapons, one may well concentrate on swords: for what is true of swords, is true of pistols and fowling-pieces and rifles and cannon and naval guns. Any of these, or spears and bows and arrows, would do as well for the purpose, but swords are selected as being weapons in the use of which the writer has a certain degree of theoretic understanding; also a quasi-practical skill arising out of an incident in Italy in 1901, which went no farther than a very thorough preparation for eventualities under the most skilful guidance.

Sword blades are made long or short, heavy or light, edged or pointed, curved or straight, according to the work they have to do, and hilts are, or at least should be, made of a size and form appropriate to a specific kind of grip, and be so weighted at the end as to make the whole weapon, guard and all, balance at, or very near, the point where blade and hilt meet; that is essential. The form of the guard is conditioned very largely by the kind of movements the blade is intended to execute, and almost equally by the kind of shocks to be encountered from movements of adverse weapons of like, or different, character; and, of course, to give as much protection to the hand as is consistent with these functions and the mobility of the weapon as a whole.

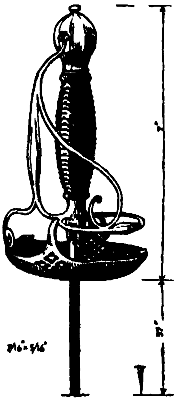

FIG. 102. A pepper-pot guard and hilt on an English Cavalier's sword.

Such are the purposes in general. Needless to say, the lighter the blade can be made, consistent with the strength required, the better. This brings up the question of material. A very good Toledo blade inscribed perhaps with some such admonition as, 'Never draw me without cause: never sheathe me without honour', will bend point to hilt, and resume its straightness on release; but it will, nevertheless, take a kink from an adequate blow rather than break off short. That is the ideal. The old bronze swords of early Greece were, for material reasons, short, broad, and thick, in comparison with the normal swords of a later day. The abnormally long swords of the sixteenth century were possible in virtue of their material, but soon became obsolete owing to their disproportion with the stature of mankind. For once an adversary with a shorter weapon got safely within their point they were useless alike for defence or offence.

That, incidentally, is a perfect example of what proportion means—a dimensional relation in form expressive of function—not one based on arbitrary ratios.

Helmet-cracking swords, for use on horseback, had to be heavy; for use on foot they had to be long as well, with a handle of length sufficient for the two hands not only to hold, but to hold well apart; the upper hand acting as a fulcrum, and the lower, or end hand, imparting the movement and largely taking the place of a counterweight. The curved scimitar is a cutting weapon for use mounted.

With the gradual abandonment of the sword as a fighting weapon for general use, and the development of the regulated duel, with equality of weapons in the interest of fair play, specialization and standardization of design within prescribed limits have affected the sword. There has, besides, been interchange of influence as between the swordplay appropriate to each type and the evolution of the type itself. So we have the highly specialized duelling sword with its triangular blade and a cup guard, the direct descendant of the small sword of the eighteenth century. This itself was a throwback to an earlier ancestor, the long sword of the sixteenth century, with its highly specialized swordplay for the effective use of the point only.

Then there is the duelling sabre, primarily a cutting weapon with a traceable descent throughout the centuries, and a hoop guard to allow of an altogether different manipulation from that of the duelling sword and to give protection against an altogether different kind of impact. This weapon, above all others, engenders a highly specialized type of swordplay. The least variation in weight of blade and balance gives character to every movement.

Cavalry sabres are of two types, the one descended from the scimitar of the Infidels, a curved heavy weapon to be swung and to give a chop, rather than a cut, and primarily useful against cavalry; and the other longer, straight, and pointed to transfix hostile infantry.

Thus the same kinds of influences are at work in the design of swords and sabres as in the design of jackets and coats—the same influences that account for the form of all designed objects—purpose, material, and technique. And in the finished article, be it sword or jacket or what not, and well designed, these three elements of form are so inextricably interwoven that the object may be said to be a synthetic expression of the elements. Now just in the degree in which this synthesis is complete, the form is appraisable as good, or bad, or of some indifferent, intermediate valuation. And just in so far as one takes delight in the appreciation of the form of designed things, one is entitled to call them beautiful, or to judge as between several examples that this is more beautiful than that.

That, in a nutshell, is really all there is to say about the aesthetic of design in its pure undecorated aspect. The fascinating subjects of the ornament and decoration of robes and gowns and jackets and coats and swords and sabres have been ignored. For it is well to keep the interest in the ornamentation of objects quite separate from the interest in the general design of objects, for the sake of clear thinking. The principles enunciated elsewhere for the choice, treatment, and disposition of ornament are applicable to all the kinds of things just considered, and to most other things to boot.

6. *Varied Interest in Things*

Now a person with no knowledge of clothes, or armour, or swords might, upon viewing a good specimen of any of these things, become genuinely enthusiastic about it. If so, it could not be the design that impressed him, for we have just imagined him as unequipped to appreciate this. But he might be a good judge of cunning workmanship; and the brilliant execution of parts, or of the whole of the thing before him might take his heart by storm; or again it may be the decoration that fires his enthusiasm, either with respect to its subject-matter or with respect to the treatment and execution.

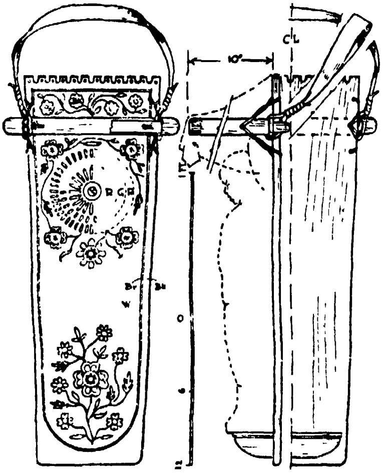

FIG. 103. Iroquois cradle-board, *c.* 1800. The petals are incised with a gouge and picked out in colour.

Once upon a time, four youths spent a happy day trout-fishing, and on getting back to their inn, began to discuss not only how much, but why they had enjoyed themselves. One said the best part of it all was the river scenery on a fine day in May; another maintained that what he liked most about it was the contest of his wits against the timidity and the nicety of appetite of the fish (these were *salmo fario*); the third averred that it was the craftsmanship of fishing 'fine and far off' with perfect implements in the way of rod, reel, line, and fly; and the fourth stoutly declared that he fished for the 'triumphal entry home', and he had the biggest fish anyhow.

And just the other day four elderly gentlemen met together to discuss the acquisition by a museum of an Iroquois cradle-board, all agreeing that it was a beautiful thing. One based his appreciation on the conventionalized flowers incised and painted on the back in red, white, mauve, and green; another liked it because of its skilful, neat, and substantial construction in poplar wood and raw hide; the third said it was just right, comfortable for the baby, convenient for the back of the mother, and secure at all times; the fourth saw it as a whole, well designed, well made, and well decorated.

7. *A Harp*

In conclusion let us examine one of the most exquisite objects ever produced by the wit and hand of man—an ivory hand-harp dating from the very end of the fourteenth century and made in France. It was apparently once the property of a princess of the blood, and is now in the Louvre, to which it was presented in 1892.

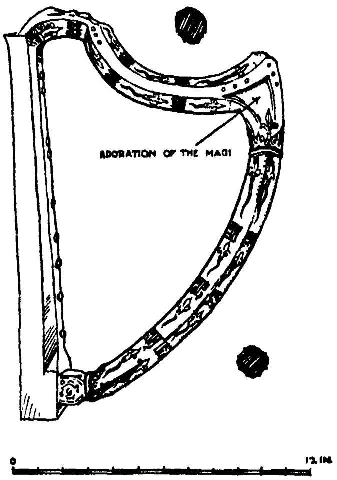

FIG. 104. A French Gothic hand-harp in ivory.

The several parts are fitted together with pins and tenons; the function of every part—sounding-box, strut, key-rail, is obvious, and their relation is ingeniously explained by their very sections, for the key-rail partakes both of the character of the sounding-box and of that of the strut. The head block, where the key-rail and strut meet, is a marvel of form, doing its double mortice work with assured substantiality and taking the key-rail more intimately than it does the strut. The strut meets the sounding-box by means of a base block butting on the larger member and modulated with chamfer and collar where it takes the lesser. Every element is proportionate to its function; the scale is maintained throughout with assurance; in all its parts the thing is not only convenient, but comfortable to handle.

As to the ornament, never was loving taste more happily inspired. The sounding-box is very plain with an incised running scroll tapering up the sides, and its chamfered faces are neatly stopped.

The strut is in section a blunted quatrefoil, the lobes and hollows running sweetly into each other, and in the hollows there appear at intervals alternately the black-letter initials of the princess and little half-open lilies with their stalks a-wiggle; the head of the strut is surrounded by a crown of conventional fleur-de-lis. The apposition between the almost naturalistic little lilies and the stiff ceremonial fleur-de-lis is full of significance. On the moulded upper and lower sides of the key-rail the initials and lilies again recur. But it is in the flat faces of the joint blocks at either end of the strut that the ornament reaches its climax of interest and execution, for here are sculptured 'histories' neatly contrived in the irregular, medallion panels in the faces of the blocks. And what more charmingly appropriate could the culture of that age offer as the theme of these 'histories'—the adoration of the Magi and scenes from the life of David the musician, shepherd boy, and king.

A good look at the poor sketch of this most lovely thing should give more of its spirit than could be imparted in ten pages of eulogy. The man who conceived that harp was a great designer of musical instruments, a great artist in form, and as a lyric ornamentalist he deserves a place among the poets of all time. But nobody knows who fashioned this thing, and few care; to these he sends his message of sweetness down the ages. And so one may see in the mind's eye as he did before the completed fact, the little princess strumming some Gregorian accompaniment to her treble chant, 'The heavens declare the glory of God . . .', while she sits attired in a dress of what we now call 'Alice blue', with golden fleurs-de-lis woven in a sprinkle.

XVI

MATERIAL AND FORM

1. *The Material Element*

THE part played by purpose in the solution of problems of form being now disposed of, it is time to investigate the part played by material. In doing so, technique will not be lost sight of; for it is hardly possible for a designer to dissociate the means and the ways of handling his means from one another; although he may be able to dissociate the means from the ends at the initial stages of his search for form.

It will be convenient to discuss the material and technical elements of form categorically, under the names of certain materials selected for exemplification; and it will be observed that in several instances the names of materials are interwoven with those of processes.

2. *Pottery*

The primitive way of making a vessel of clay is to roll the damp clay into long worms and knead these down on one another, or to take a lump and twist it round by hand on a wet board, shaping it up as it grows between the hands. The successive finger-prints may be left to tell their own story, or the outside may be smoothed off. Such a process does not admit of the production of a tall narrow-necked vessel. The product will only be approximately circular in plan. A flower-pot, or low dish profile is all one can expect. But with the aid of the potter's wheel to do the turning, an accurate circular horizontal section is readily attainable—more so indeed than one of any other shape—while there is no limit to the smoothness of the exterior or the delicacy of the profile. But if handles are required, the maker must revert to the worm of clay and the finger-print, or some mechanized process to carry out the same operations. For oval, square, or oblong dishes, and those with some complexity of form, moulding must be resorted to. Whether spun, or moulded, the clay must be dried out and burned, and that introduces the complications of shrinkage. While moulding and pressing are possible, the setting up of wet clay by spinning on a potter's wheel remains pre-eminent as the most direct, usual, and inspiring process. As the raw material of pottery is soft and the finished material is brittle, a certain thickness is characteristic, especially in the lower parts; but extreme refinement of contour is the intriguing characteristic.

3. *Textiles*

Of textile materials and processes, not much could be said as to form, except in basket-work, which is a textile industry, for here also the foundation is warp and woof, with the interlacing of the latter through the former. In ordinary weaving the product is, of course, a flexible plane, while in basket-work, cylindrical, conical, and spheroidal rigid forms come naturally. The addition of pile to an ordinary textile by knotting in additional material, which may be cut on each line of the woven fabric, introduces a third element. The warp and the woof are not infrequently of different kinds of yarn or thread, and the pile is nearly always different from the basic material. The raw material of the fabric is usually fibrous; either plain, or twisted to give additional tensile strength. The chief interests of material and process in textiles are in their relation to the development of pattern and ornamentation, matters not now under consideration. The differences of the textures generated in knitting, in weaving cloth of threads, and in weaving baskets of withes, are significant for the present purpose of relating material and techniques to basic form.

4. *Wood*

The chief characteristics of wood are grain, swelling, and shrinkage. The facts that wood splits more readily with the grain, that it can be cut more easily in the direction of the grain than against it, that its tensile and compressive strength vary with respect to the direction of the grain, and especially that wood shrinks more across than with the grain, all have far-reaching influence on the techniques for reducing it to serviceable form. Besides all this, different kinds of woods vary greatly in their strength, hardness, durability, elasticity, and so on. They all have grain and they all shrink to some extent, and they all go in and out like concertinas with changes of humidity in weather or climate. These are the main points.

Chopping, sawing, planing, turning, drilling, and cutting with the chisel, or the gouge, are processes so familiar that they need no comment beyond the reminder that the grain is always there. Methods of fitting pieces together by means of checks, rebates, grooves and tongues, tenons, dovetails, and feathers, require only enumeration to introduce them into the argument that follows. The same applies to pins, nails, screws, and glue. Moreover, there is no need here to differentiate between the methods of machine and handwork; but in this connexion it may be remarked that very few machine processes for woodwork are superior in any way to hand processes, and most are vastly inferior.

It is important to distinguish clearly between the character of solid wood, veneered wood, and ply-wood. In the case of solid wood, no matter what the seasoning, a continuous general shrinkage over a period of years must be reckoned with and a certain amount of seasonal swelling and shrinking. Veneers of precious woods can be applied to plain surfaces and to surfaces with curvature in one direction only. When this is done a veneer of similar shrinkage should also be applied on the reverse side to prevent warping. It is a mistake to consider veneered work as fraudulently imitative of solid work in superior material. It is best to regard it as a kind of prepared wood, having both the qualities of the core and of the surface skin. Obviously this kind of wood has very distinct limiting influences on the form of objects for which it is employed. Ply-wood, whether homogeneous in material or having something of the dual qualities of veneered wood, is also to be regarded as a kind of prepared wood. If of good stuff and well made—it is often inferior in both these respects—it has many virtues. The chief of these is size without joints; after this comes its comparative freedom from warping and shrinkage. This latter advantage is obtained by having the grain in a five-ply sheet run in four different directions, an arrangement which may result in the glue and the wood tearing each other to pieces if the manufacture was defective, or the exposure to alternate drying out and swelling with moisture too severe. Properly made and properly sealed, ply-wood has very great possibilities. Veneer has been in general use for four centuries and probably originated in the intarsia process which replaced the solid inlay technique of Bramante's day. Ply-wood has been developed during the last half century.

A fourth and comparatively modern kind of prepared wood may be mentioned: faced work on a built-up core. This originates in frame building where a rough construction of sawn studs, joists, and planks is protected by finished facings of closely fitted dressed material. The application to interior fittings and cabinet work involves the use of glue instead of nails. The core is built up of small thoroughly seasoned pieces—the limited thickness making such seasoning possible—and the facing, often of a different wood, is then glued on. Cored-and-faced work suffers far less from subsequent shakes and warps than solid work and is not to be regarded as a base substitute.

It is really immaterial whether one considers these prepared woods as 'kinds' of material, or regards their preparation as part of the technique. If the latter, then it is a technique for the preliminary improvement of the material rather than one for its reduction for actual construction. What does matter is for the designer to realize that solid wood and the various kinds of prepared wood can each be made to serve in certain ways with ease and success, while, in other ways, their uses may be very difficult and certain to generate defects. To reproduce solid wood forms in built-up work, or vice versa, is not design at all, but representation. It is not a criminal offence, but a fatuous proceeding at variance with the evolutionary process which is the life of creative art.

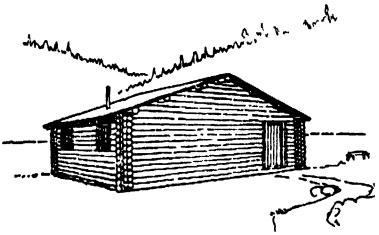

FIG. 105. Log cabin with no elaboration.

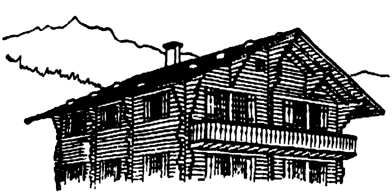

FIG. 106. Swiss chalet showing elaboration of form derived from structural method.

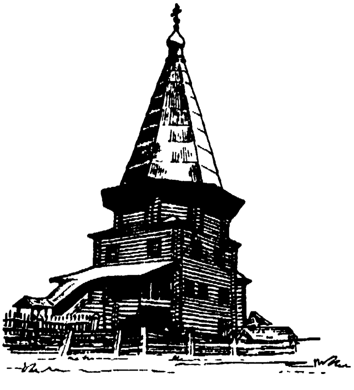

FIG. 107. Church of S. Dimitri Ssolumski, Vologda, Russia, eighteenth century. (*Russische Baukunst*, Müller.) Log and board forms solve the problem. The top is in metal.

For buildings, wood has been used mainly in three ways throughout Europe and America; solid softwood log construction, as perfected by the Swiss, the Scandinavians, and the North Russians under Scandinavian influence; solid squared hardwood exposed frame construction, as perfected in French and English half-timber work; and framed and cased softwood construction, as perfected in New England and Virginia. The wood architectures of the Far East and of tropical countries, involving teak, palm, and bamboo, may also be mentioned. In each and all one finds form largely generated by the kind of wood available, and by the means devised for its reduction to obedient service.

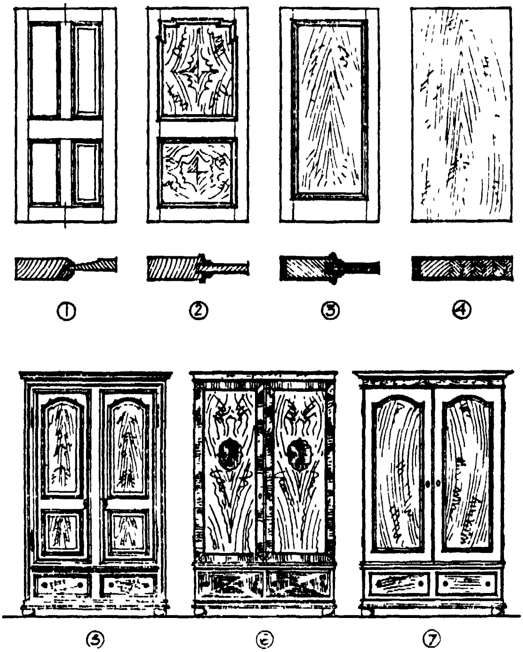

FIG. 108. 1, 2, 3, 4. Doors designed for various constructions in wood.
5, 6, 7. Armoires in solid wood, in veneered wood, and in ply-wood.

A consideration may now be undertaken, in somewhat greater detail, of the proper use in joinery and cabinet work of solid wood, veneer, ply-wood, and cored-and-faced work, taking a door, an armoire, and a table as the objects.

There is, then, first of all, a door in solid wood to deal with. In France, where the joiners are most skilful and the climate equable as to moisture, a perfectly good solid door that will not warp in a lifetime can still be made, as such things have been made for centuries, with the framing less than 1½ in. thick. In England and in America, 2 in. is the usual thickness. The frame will be put together with tenons and will have grooves for the panels. The panels will be of limited width for two reasons; the wider they are the more they will shrink, and the market size of sound board, or plank, is limited by the way trees have of growing by rings, with heart-wood in the middle and sap-wood outside. There may be six panels in three tiers, or three panels the whole height, or say six cross panels. If the panels are made of stuff thicker than the width of the grooves, they must be fielded or checked; if there is a lock-rail it may be made wide for double tenons and a mortice-lock between; but the sensible French joiners prefer rim-locks on their thin doors. The thickness of the door also has a bearing on the attachment of the hinges (edge, or face) and the frame around the door is affected by the type of lock and hinges. Mouldings may be regarded as ornaments and are of no concern at the moment, beyond informing any reader totally ignorant of joinery that the mouldings do not hold the panels in place, but mask the inevitable shrinkage at the joint by their high lights and sharp shadows.

If the door is to be veneered, there are, of course, all sorts of ornamental things one could do with the veneer, but these do not affect the form. Veneer will not improve the styles and rails, for these have edges exposed to wear and tear, but veneer can be very well employed on the panels. These can then be built up of boards feathered together before being veneered, and may thus be made larger. Indeed, the door might be made up in one panel.

Now, if ply-wood is to be available, there would not be much sense in designing the door otherwise than as a one-panel door. But one cannot make the styles and rails or the mouldings of ply-wood; these are all right in solid stuff.

But if cored-and-faced stuff is available, one can build up the styles and rails and face them before cutting them out, and still use a ply-wood large single panel. Perhaps, however, one is in search of the utmost sanitary simplicity. If so, one may make the whole door up as a slab of coring cased with wide stuff which really amounts to being a ¼-in. veneer, instead of the usual $\frac{1}{32}$-in. veneer.

So if our door has remained the same in size, say 2 ft. 10 in. × 6 ft. 9 in., it has at least not remained the same in form under the influence of the various materials and techniques successively considered.

Now as to the armoire: the front must have a frame of some sort to take the doors and drawers; and top and bottom members are likely, as well as a top and a bottom; and there must be sides which are nearly as visible as the front. There will be a back against the wall, and probably four feet, even if they are just flattened balls. If the armoire is to be built solid and in oak, it will turn out very like a Normandy cupboard. The folding doors may each be in three panels, and if they have wiggly Normandy rails, that is a matter of playful decoration. The doors may be checked into, or set within the frame. The bottom and top members, whether moulded or plain, will be mitred at the returns. The sides may be of frame-and-panel construction, or of one wide plank, or out of a thick plank cut up the centre and opened out to show the repeating pattern of the chamf (which is decoration), and if so, the centre joint will be feathered provided the joiner knows his business. The floor will be close boarded and the back may be frame-and-panel work, or of grooved-and-tongued boards. Perhaps the base is made deep enough to contain drawers. If so, their fronts will be solid.

But suppose veneer is to be employed where possible on all plain surfaces. Then the ends will be veneered and the panels and the drawer-fronts; and perhaps, too, the base and frame and head with cross-banding. The doors might even be veneered flush all over, like miniature cored-and-faced slab doors. The corner pieces of the front frame might be the only members to escape this treatment and be made solid. Great simplicity and severity of form would result; but if the thing had been made in the days of Louis XVI it would be enlivened by inlay decorations.

If ply-wood is to be used for the construction of the armoire, it could be employed for long panels in the doors and the sides, and perhaps in the back and top. That would give quite a different character to the thing, with the emphasis up and down.

Should cored-and-faced work be made use of, it could hardly find application except for the front frame and the head and the base.

And now there remains the table to deal with. In solid stuff the legs and top frame and the stretchers, if any, would all be tenoned and perhaps pinned together. Every place where tenons entered mortices might with advantage be kept square, whatever happened in the way of modifications such as turning (for comfort or decoration) between these points. The top would be a separate piece, of course, buttoned to the frame to allow for shrinkage. It might be made of boards feathered together, with dovetail dowels sunk in the joints for greater security and having dovetailed cross-pieces partly countersunk in the under side to keep the top from warping. That would be the best way. But if the table were sure to last out its days in an equable climate where the air did not dry out with hard frost and then become further desiccated with artificial heat indoors, the top might be flush-panelled with mitred cross-ends.

But supposing one is about to use veneer wherever possible; then the top will certainly be veneered and the edge will have to be trimmed to keep the veneer from being split off by wear and tear, the top edge of the trimming coming flush with the veneered face. The rails of the frame might then perhaps be cross-banded, but, if so, they will need a beading on the lower side to protect the edges of the veneer. The legs are, of course, no place for veneer.

Ply-wood is not suitable for any part of a table; but if cored-and-faced work is to be employed, one could do something with that. The rails of the frame can have a laminated core faced on the outside. The legs can be cored-and-faced, the cores being made of pieces as small as 1 in. × 1 in. glued together. The top could be made of a built-up slab with a faced top, in which case it will be trimmed all round on the edge with a facing and turn out a good deal thicker than a solid top need be. It should last far better and, if suitably sealed on the under side and finished on the top, might be secured direct to the frame instead of being buttoned on.

Now that is just the way the furniture of different periods has been evolved and received its characteristics of form—by using available material in the most natural and effective way of which the available technique would admit. One may design a door, an armoire, and a table, or anything else for that matter, along such lines as an untrammelled fancy or a past experience may dictate, and then decide what will be the best natural or prepared kind of wood to use, in view of the character of the form one is after; but when it comes down to detailing the thing and making a working drawing, one will have to decide on material and find out just how all the parts are going to be put together, if the thing is to be any good. One must think in terms of materials and techniques almost from the beginning, or nine times out of ten one will, at the best, only be recapturing a form one has knowledge of, which some one else discovered long ago. That again is no crime; but the exercise of a selective and judicious taste must not be confused with the discovery of form. The stylemonger may console himself with the thought that it is often better to rely on tradition and cause a form to be repeated than to rely on original inspiration and be laughed at by the cabinet-maker who seeks to understand the detail drawings. But with a proper knowledge of the uses and purposes of the thing to be made, an intelligent appreciation of the genius of the material to be used, and a thorough mastery of the technique to be applied, it is always possible to make a real discovery of form, and, if the same discovery has been made before, what does it matter? There is little virtue in originality for its own sake; to be of value it must be a contribution to the evolutionary process. The connoisseur knows at a glance whether he is in the presence of an object that has really been designed.

5. *The Sculptor's Materials*

Now let us turn to sculpture and look at it not as a very Fine Art, with a capital F and a big A, but as a matter of craftsmanship. Your sculptor is engaged upon a figure—never mind who it is or what it symbolizes. The figure is to be of bronze. Then there is no reason under heaven why it should not balance on one toe if the sculptor wants it to. It will be cast hollow in any case and can be made very light and thin, as all rearing horses in equestrian bronze statues are, and the ankle taking the weight can be almost solid and the foot and toe quite solid.

But your sculptor could not do that sort of thing with a marble statue because it would have to be solid and heavy and the ankle would be brittle under a shearing stress and the toe might crumble up, if ever the weight got down so far. So here again one finds material and technique in league to have their say in the determination of form.

6. *Building Stone*

Let us turn to building materials—such obdurate media of expression as stone and metal and concrete. By building stone is meant stone that will stand the weather for centuries. That is more important than strength. Such stone varies very considerably in strength and hardness. The latter is best considered in relation to cutting costs, which vary within a range of about 1 to 10. The cohesive strength of certain kinds of stone makes their use for large horizontal members possible. Brittle stones do not lend themselves to such uses. Crushing strength is of little importance, as the weights of building stones vary from about 120 pounds to 180 pounds per cubic foot and crushing loads vary from 140 tons to 1,400 tons per square foot. From these figures one may infer that any ordinary sound stone could support a wall much higher than the wall of the tallest building in the world without being crushed. The strength of built masonry is quite another matter. Mortar is not glue.

It is not the strength of stone but the available size that has such an enormous influence on form in building. Next to that comes the difficulty (reflected in the cost) of cutting. Size in stone depends primarily on geological formation—the big stuff exists, but can it be got out? The writer once saw a solid block 47×18×12 ft. dislodged from its bed at Darley Dale. But this splendid block was never available as it would have to be cut up to go through the tunnels on the railway; the hills of Derbyshire were in the way. Egyptian, Roman, and Russian rulers, with very primitive appliances but an abundant man-power to back them, have on occasions taken delight in the expression of the power of the social systems over which they presided by quarrying stones of sizes and weights of the order of the block seen at Darley Dale and moving them to their appointed places. With modern cutting plants, such as the famous one for granite at Beebe in Quebec, there is actual economy in dealing with very large blocks. But transportation must always be taken into account.

The architecture of western Europe and the British Isles throughout the medieval period, and long after, became what it was very largely in virtue of the facts that most of the limestone and sandstone, near to places where building was required, occurred in small beds, and that the roads had fallen into deplorable condition after the Roman power decayed. Stones weighing a ton are rarely to be found in even the largest buildings of the period—the castles and cathedrals. Stones of half that weight are infrequent, and the average block in face work, piers, and arches, is far less. Gothic architecture is an affair of small stones, often of a size suitable for half a mule load.

A word on rubble work. The genius of material is not confined in stone to the higher classifications of hewn and dressed ashlar. The rough stuff from every locality, be the quarry a road-side hole or a veritable transformation of the landscape, has its characteristics of size and shape. The rubble masons of the Galashiels district in Scotland are past masters in making sound and neat walls out of the most intractable whinstone, not at all discouraged by the proximity of Melrose Abbey hard by which flaunts all the charms attainable in a superb freestone. Texture at first sight may appear to be something other than form, but as every kind of cell-structure has its characteristic pattern, so every kind of rubble material, when properly laid up so as to form a lasting wall, has its characteristic pattern. This is always worthy of exploitation by a designer who has occasion to take account of humble materials. Between the roughest crash or homespun and the finest lawn or broadcloth there are many intervening classes of fabric—so with masonry. A dry-stone dike has its qualities, and a wall of squared finely dressed ashlar with equal courses and the perpends rigidly kept has its qualities: between the two there are infinite grades appropriate to various occasions and having a profound influence on the resultant texture or general joint pattern.

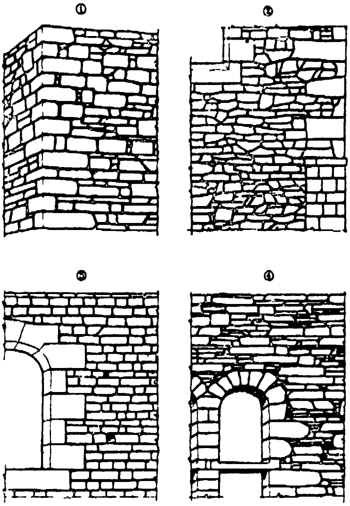

FIG. 109.

1. Quoin of Old Mill, Chateauguay, Quebec.
2. Tower, Carolles, France.
3. Aisle wall, Carolles, France.
4. W. wall, St. Magnus, Kirkwall, Scotland.

It is not necessary to enter into a disquisition on stone-hewing and to moralize on rustication, beyond saying that modern methods, even for the reduction of plain wall ashlar from the rough block, when properly understood, are full of suggestion for the designer of buildings. Because many old ways have proved good ways it does not follow that any new ways are necessarily bad. The sawn bed has its advantages and its difficulties and the sawn face its temptations and charms.

Reference has been made to medieval architecture as largely a product of ways and means of dealing with small stones. These were usually of such a quality to demand very great ingenuity in devising forms for shedding the rain. Now consider the buildings on the Acropolis at Athens, where there were fortified walls and holy places, as there were also on the ridge at Durham. But the Athenians had at their disposal the marble of Mount Pentelicus, a building material of unsurpassed intrinsic qualities—white originally, but weathering to a warm gold or honey colour, even, dense, and hard without being brittle—readily available up to blocks of eight tons. Throughout the Parthenon from its broadest structural dispositions to the minutest details this stuff is having its say. It is all very well to wax eloquent on the Greek view of life, and the Greek culture and the Greek economic system as finding expression in the Parthenon. If the Greek mind fathered it, the bowels of Pentelicus brought it forth. The stuff those Athenians had to build with has as much to do with the characteristics of their architecture as anything else.

In this connexion it is worth recalling that Sir Christopher Wren's first design for St. Paul's provided for only one great order of columns related to the main walls. When he found he could not get drums of the size required from the Portland quarries, he very sensibly changed the design drastically, and made use of two orders. Even if it were disproved that he did any such thing, the story would remain fundamentally a true one, illustrating as it does something in the very nature of design.

7. *Sheet Metals*

The metals and the technical processes for their subjugation show greater diversities than those to be noted in the case of building stones. Besides this, the metals have been the subject of far-reaching improvement within recent times, both as to production and manufacture, especially within the last thirty years. Who ever thought of pressed sheet steel or electric welding in the gay nineties? The new alloys are a veritable source of inspiration in design.

Yet, taken by and large and whatever the name of a parent metal

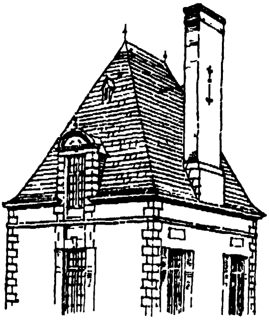

FIG. 110.

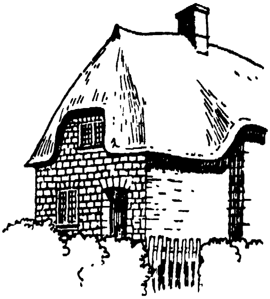

FIG. 111.

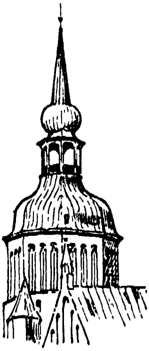

FIG. 112.

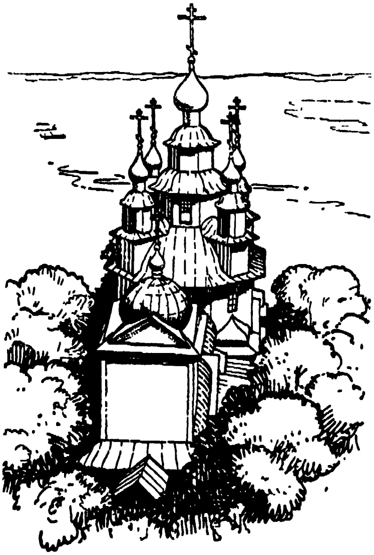

FIG. 114.

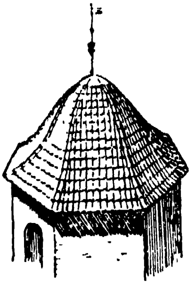

FIG. 113.

FIG. 110. French slate roof. FIG. 111. English thatched roof.

FIG. 112. Hanseatic copper roof. FIG. 113. Danish tile roof.

FIG. 114. Church of the Ascension, Klinzy (Tchernigov), 1780. (*Russische Baukunst*, Müller.) Note sheet-metal roof forms.

may be, or however mixed an alloy's genealogy, a few old processes remain characteristic of all. Sheet metal, for example, can be bent in one direction with the simplest appliances. Roofing forms for copper, tin, and iron must ever be designed with due respect to this behaviour.

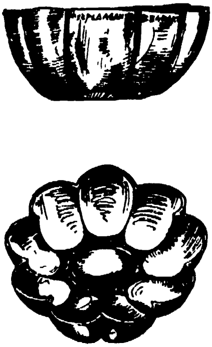

FIG. 115. Bowl of the Sons of Cypselus. Early Greek, B.M.

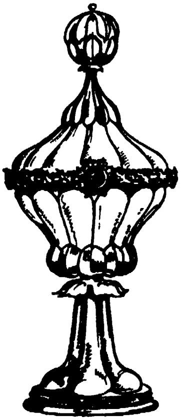

FIG. 116. The Richmond Cup, *c.* 1500.

Most metals that can be prepared in sheet form are 'ductile', given adequate appliances and in some cases adequate heat; but one may reserve the descriptive use of the word for those which can not only be bent cold but made to flow when subjected to beating with a blunt instrument while cold. A sheet of copper or silver can be beaten up into a narrow-necked coffee-pot or vase by a skilled artisan. Beginning at the centre, which will be the middle of the bottom of the vessel, and working round and round spirally, he thins and swells the metal at each blow. Part of the displaced material flows into adjoining portions of the sheet. It is like blowing a bubble at successive points. The bowl of the vessel becomes very thin and the neck may thicken as the original surface is contracted. The greater the curvature the stiffer the form. Corrugations and bosses, as further modifications of the general form, thus give stiffness besides masking inequalities. Hence the quasi-decorative use of the boss in so many beaten metal vessels of all periods. That the boss polishes up readily, revealing all the glories of high lights and reflections is, of course, an incentive to its use over and above its practical value. Repoussé ornament is just a decorative exploitation of the possibilities of the boss. The forms that can be derived from a single piece of sheet metal by beating are strictly limited. A chalice, for example, may have a beaten cup and a beaten base, but the stem between is more readily made as a casting. Or the top half and the bottom half of the body of a ewer may be separately beaten and jointed at the centre by brazing or riveting, or by attachment of both parts to an encircling collar. The neck might be a third beaten piece fitted to a hole cut in the top of the main body of the vessel thus constructed. The combination of bent sheet with beaten sheet is an obvious possibility.

8. *Cast Metals*

For a full and enthralling description of what is involved in the casting of metals one cannot do better than read those pages of Cellini's immortal autobiography which describe his tribulations with the waste wax process, but a visit to a foundry may be as profitable. Suffice it here to say that any form that can be given to a model or pattern can be cast—in a whole, or in parts, solid or hollow. Fundamentally the process is the same for a bath tap or a statuette. But to say that any form can be cast is not the same as saying that all forms can be equally readily dealt with. The process has its very suggestive limitations as to the practical, if it has few as to the possible.

Then again the stuff cast has a good deal to say. Bars and balusters for a railing can be cast in grey iron as slim as you will; but it is brittle stuff, though hard, and demands on that account very different dimensioning from fibrous wrought-iron bars. The magnificent cast-iron railing surrounding St. Paul's Cathedral owes its life to its splendid substantiality, while thousands of miles of thin spindly cast-iron railings have been broken to smithereens by legitimate wear and tear. It does not suffice that a railing should stay up; it must resist intrusion.

9. *Wrought Iron*

Wrought iron is endowed with a very different kind of strength from cast iron. It will bend far before it will break. It can be cut readily and welded at will. When heated it can be twisted, bent, swaged, and hammered out in a great variety of ways. It is to be seen at its best in Spanish 'rejas', Georgian gates, and French Renaissance door-furniture. With the aid of sheet metal there is hardly any limit to its applications to the apparatus of life. After all, ships have been made of it and are still being made of something which is only an improved variety. The designer of wrought ironwork must bear two things in mind—the weight of the material and its lack of elasticity. It bends without breaking, but it does not come back to its original form.

10. *Steel*

Now steel is different from wrought iron in many ways. It has superior strength—some kinds have phenomenal strength—and this enables it to be used in small dimensions for prodigious stresses both in compression and tension; it also has great elasticity. But it is a most obdurate material to work and to reduce it to our needs machinery must usually take the place of handiwork.

Thin sheet steel has now an importance in the ordinary apparatus of life second only to that of wood; while structural steel has during the last half-century revolutionized not only the building of ships, but all large construction. Its application, whether as a framing or as a reinforcement to a concrete framing, has greatly modified the function of exterior walls. In a steel frame building an outside wall is for enclosure only, and its time-honoured other function of support for floors and roof disappears. Once steel is enlisted in the solution of a problem, it tends to dominate the form. Most other materials the designer has to reckon with are content to have their say. That architects should so long have resisted the authority of this material is a matter for psychologists to explain, if not for alienists to deal with. The signs of the capitulation are now become manifest on all hands.

11. *Concrete*

Theoretically concrete, with reinforcement, is the most versatile and accommodating of all the materials designers have ever had to take under consideration. But its chief ingredient is made hurriedly by men in a mill; and not by gods in the everlasting hills in geological measures of time. Furthermore, when concocted ready for use, the fallible undisciplined claimants of free will get at it again. Perhaps the best concrete ever made outside a testing laboratory was produced by conscientious Italian labourers under Prussian army-trained foremen in pre-war Germany. The truth is that one must take the human factor into very serious account with this material. Besides, there is a certain ineradicable behaviour that is of its very nature—it goes on shrinking appreciably for about ten years after it is laid and inappreciably long after that. Such precautions as can be taken to mitigate this unfortunate characteristic must depend for their success upon a discipline which may some day be characteristic of mankind. But happily neither the reader nor the writer will live to see the dawn of that dreary day.

Portland cement concrete is a material which completes the main process of its constitution, physically and chemically, within an hour of its finding its place in a building. What chance is there that any two contiguous cubic yards of the stuff can really be similarly constituted in so urgent a process? With a cement which increased in bulk while setting, as plaster of Paris does, and never shrank thereafter (except under the influence of temperature) the thing might have its possibilities for permanent structures in all their parts. As things are, the stuff has temporary uses. Its very strength destroys it; and in extreme climates it perishes apace when the weather gets at it.

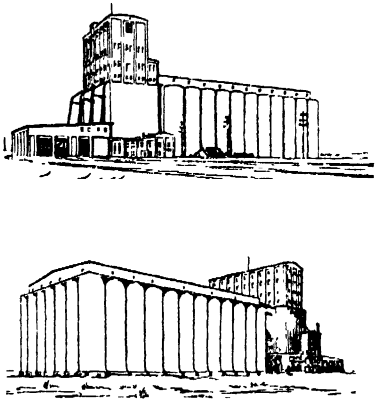

FIG. 117. Canadian Government Elevator, Edmonton, C. D. Howe, 1924.

Note how form derives from function of the several parts. The human scale of the minor adjuncts reveals the size.

What all this amounts to is that the designer need not take his concrete in the serious way he must take his steel. It will serve him well for humble purposes such as foundations and floors and for a time only. Bear in mind that a wall set in cement mortar can be run up quickly because the mortar sets quickly, but bear in mind also that every joint will shrink, the mortar adhering to one or other of the bricks or stones; also that water can find its way into every one of these cracks by capillary attraction and that it may freeze there. Compare such modern masonry with some century-old harbour wall facing the North Sea where the original boiled lime mortar, the lime of which was slaked up and kept seven years underground before being used, is still doing duty. Or read Vitruvius on mortar and plaster-work—it is perhaps the thing best worth reading in his ten 'pernicious tracts'. But do not ask of Portland cement that it should do what it cannot. It is a good servant so long as you keep it in its place and treat it very well, but never too seriously.

But if reinforced concrete were already in fact what it is in theory, what a fascinating perspective would open to the designer; what clever things one could do with its help! Meantime, one may admire the temerity of those who act on the assumption that poured reinforced concrete is already a building material fit for serious purposes. When one builds in stone there is enough trouble with the joints. Poured concrete is not a jointless material. It is a material that is altogether joint. *Hinc lacrimae.*

The technique of concrete construction, however, has its very definite suggestions and implications of form. Slab construction and web and beam construction have each their own proper distributions of material, while what is known as mushroom construction produces a distinctive form of capital between the column and the supported floor.

Then again, just as the mould has to be taken account of in designing the statue to be cast, so the formwork of concrete has its implications. This is only secondary to the mathematical calculations as an ingredient of form in concrete; and it may fairly be anticipated that future development will be increasingly influenced by ingenuity in contriving the formwork, and in enlisting new materials and techniques for this essential stage of the work.

XVII

ELEMENTS OF THE PLAN

1. *Analysis of the Problem*

THE reader who has persevered thus far will begin to realize that when one sets out on the discovery of a form, an orderly mental procedure should dictate the course. If one sails before the winds of whim and fancy one may, by good luck, sooner or later find the island; but one may waste a lot of time and cover oceans of paper, quite unnecessarily, in doing so. More likely, one will be diverted and find something quite different from what one is in search of, put it in the waste-paper basket and resume the course anew in great confusion as to what is now the point of departure. A rigid control of the courses is essential. The designer is not in search of any island at all of a kind on which no one has landed before, but of an island where such and such things grow or lie buried in the soil, or where the weather is of a certain nature: otherwise one is a fool to outfit the ship and embark. The discoverer of form does not know just where he is going, but he does know to what archipelago to direct his course. He is looking for something, perhaps unique, but something of a certain kind—something that will fulfil the requirements.

In this search one proceeds by courses, or to vary the simile by steps, each related to those behind and to those to follow. Design does not involve mental processes of those higher orders which distinguish philosophers, physicists, and astronomers from the rest of mankind; but it does demand a mental discipline of a very rigorous kind. Otherwise there is loss of control of the sympathies and understandings and imaginings and prejudices. By so failing an architect serves his client ill; and he uses himself worse.

An analysis of the highly complicated relations of the commonplace requirements for a house will serve to make all this clear. Let it be an ordinary one, neither cottage nor mansion. Just the kind of habitation most civilized modern people aspire to but do not achieve—a two to three thousand pound house, which a householder with an income of from eight to twelve hundred pounds might venture on, if content to spend modestly on food and raiment and amusements and not to educate his small family too expensively. It is a very favoured land in which 10 per cent. of the population are as well housed as that; and it is a backward country in which 50 per cent. of the population do not aspire to be so housed.

2. *List of Requirements*

The first thing to do is to ascertain the requirements, which may happen to be: larder, *kitchen*, pantry, dining-room, *living-room*, study, *own bedroom*, children's bedrooms (say three), spare bedroom, maids' bedrooms (say two), bathrooms (say three), laundry, *furnace-room*, tool-house, garage, and storage-places (five kinds). Now it will depend on the idiosyncrasies of the inhabitants whether the kitchen group, the living-room group, the bedroom group, or the furnace-room group require further subdivision and elaboration, or can, with advantage, be simplified. For example, if the servants eat in the kitchen, a scullery may be desirable, or there may be the question of a servants' hall. And how much housework does the mistress do, and is she interested in cooking? Can the dining-room, living-room, and study be amalgamated, or can any two of these be joined? Are any of the bedrooms to have private bathrooms? Expense precludes there being a bathroom for each. What is the relation of the children's quarters to the 'own bedroom' and to the servants' quarters? Must the furnace-room open to the outside without any passage through the laundry? What storage has to be taken account of—wine, vegetables, jam, trunks, linen, clothes, toys?

These and a host of other questions must be decided before the various rooms and groups of rooms can be broadly conceived, or even dimensioned. The answers will incidentally throw light on the circulation, or connexions, required; but it is still too early to let the mind's eye visualize these things, or to commit anything to paper. If that is done too soon the whole skein will tangle for a certainty.

3. *Circulation*

One may perhaps decide at this stage that there will be the following elements comprised in the circulation—back door and porch, front door and hall, back stair (up and down), front stair (up and up again) and passages on all floors, furnace-room with outside and inside doors and possibly a garden door from the living-room.

If the kitchen group and the living-room group are to be on one floor, that entire floor of rooms could be contrived with no passages.

The connexions may be dealt with on any one of three principles,

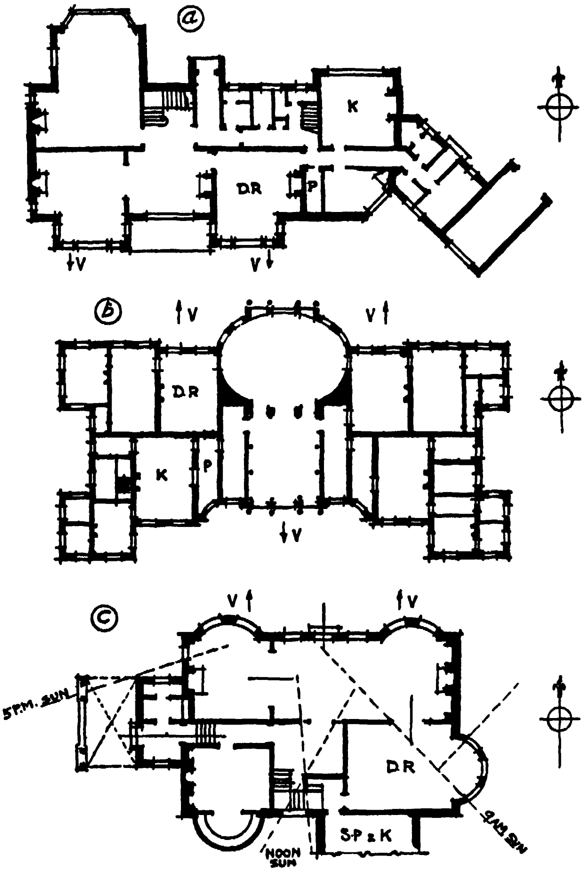

FIG. 118. Three types of house planning for prospect and aspect. *a*. Closed, English. View to S. *b*. Suite, French. Views to N. and S. *c*. Open, Canadian. View to N.

or by mixed methods. By *closed-planning*, where the disconnexion is given equal importance with the connexion. That is the English way; each room has its doors and its draught-provoking fireplace, and passages are essential. By *suite planning*, where the connexions are from room to room in logical sequence. That is the old French way and is based on the assumption that privacy is not the most important thing in life. By *open planning*, where connexions are achieved by the omission of enclosures wherever possible. That is the American way and results largely from overcoming draughts in winter by the distribution of heating apparatus. A judicious mixture of these three methods is generally advisable.

Two principles for the location of passages may be mentioned. The passages may be made most efficient by placing them centrally, so as to serve as many rooms as possible with as short a length as possible. That is the way to deal with them in an English or North American house. But in a West Indian bungalow there would, for climatic reasons, be a surrounding piazza, or gallery, off which most of the rooms could open, with an occasional internal room-to-room connexion. This latter is an economic form of passage-way, for it only comes into existence when it is wanted, traversing an element of the plan, otherwise essential, without detriment to its use.

4. *Analysis of Plans*

A plan may be analysed with respect to effective areas, circulation area, and walls, flues, and lost space. The areas of all the nameable rooms comprise the effective area; the areas of all porches, halls, passages, corridors, stairs, and stair-landings constitute the circulation area; the walls, partitions, chimneys, and so on make up the balance. Economically speaking (and there is not much money to spend on this house) the best plan is that with the highest ratio of effective area. But effective area is sometimes more apparent than real. On each side of every much-used door there is an area which is really passage-way: usually twice as much on the side to which the door opens as on the other; say anything from 9 to 25 square feet according to circumstances. A short length of plain honest passage often achieves twice its area elsewhere in really effective floor space.

5. *Diagram of Relations*

At this stage a list may be made in writing, or by diagram, or in one's head, of all the rooms wanted: representing them all by circles the same size in a row, each with the name of a room on it, is a good way. The next step is to determine their approximate minimum sizes—dining-room, 14 ft. × 18 ft., own bedroom, 16 ft. × 13 ft., study, 11 ft. × 13 ft., and so on, and set them out in a row to scale.

Now one probably gets a little frightened at seeing how much effective floor area there is, and how great the cubic contents will turn out; also how economical one will have to be with the connexions.

So far there is a row of circles, all of a size, and a row of parallelograms to scale, each row thus representing all the rooms. Next one may draw in lines and loops among the circles to show the connexions one is asked to provide, or those that one thinks appropriate: a line from the kitchen to the pantry and another from the pantry to the dining-room, and one from the living-room to a half circle some distance away marked 'front door', running through the circle marked 'main hall', and off this a zigzag or barred line marked 'front stair', and leading to a line of any necessary length and curvature with little twigs off it connecting to the several bedrooms one may wish to place on the other floors.

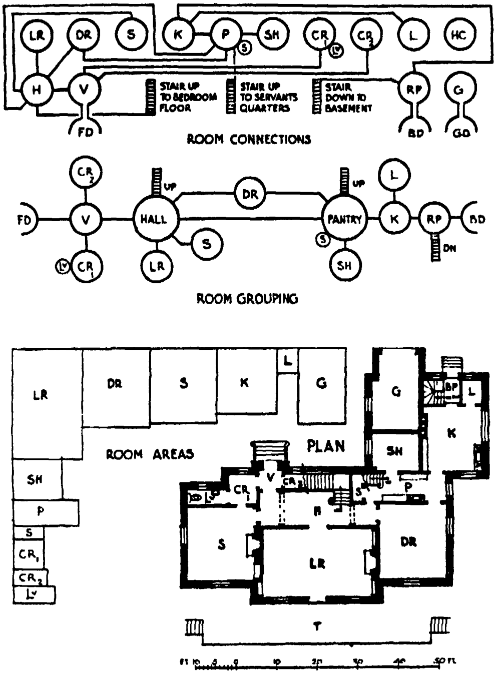

FIG. 119. Successive steps in solving a problem of planning.

In this way one gets all the essential connexions laid out in a tangle among the circles. Next the circles should be regrouped to simplify the diagram. The organism is now displayed before one. The plan at this stage is like a medical student's dissected animal, with all its organs neatly spilled out and some of the connexions stretched, but none broken. Now, keeping the organic elements of our plan all properly related, they have to be put inside a skin consisting of walls and roof. As yet one has no idea what shape the skin will take beyond perhaps knowing that the roof will be pitched 40° and the walls be vertical. As one can't put the puzzle together all at once, one must do so bit by bit and taking account of the sizes of the rooms in doing so.

So the next step is to take the probable ground-floor rooms and start laying them out with their connexions, direct room to room and indirect from passages or landings, taking, first the kitchen series—back door to dining-room—and then the living-room series—front door to dining-room. Now the thing begins to look really organic in places and one sees what doorways, halls, and passages are needed and also whereabouts they are likely to come so as to solve the circulation problem. Before going farther the other floors should be organized, each in its own best way, and still diagrammatically. One now has the separate elements; one has their dimensions; one has their arrangement among themselves in principle; and it is time to look outside and around.

6. *Topography*, *Prospect*, *and Aspect*

The site may have been found first, or one may be about to find a suitable one now; and in either case it has to be studied before one can go any farther with the plan. What size is it? Is it big enough for a garden and a separate garage, and is it flat or sloping? What views does it give? Just the road in front and the flanks and backs of other houses, or can one see a turn of the nearby river and some blue hills far away to the left front as one comes in from the road? And, most important, how does it lie—north-east or south-west of the road which runs north-west out of the town? With the topography, prospect, and aspect of the site clear in one's mind one can decide in what direction the more important rooms should face. The dining-room to the east, because sunshine in winter is so nice at breakfast-time; the living-room to get the view and also something of the garden, and, if not both, then which? The garden will flourish best to the south-west of the house. Then again, the

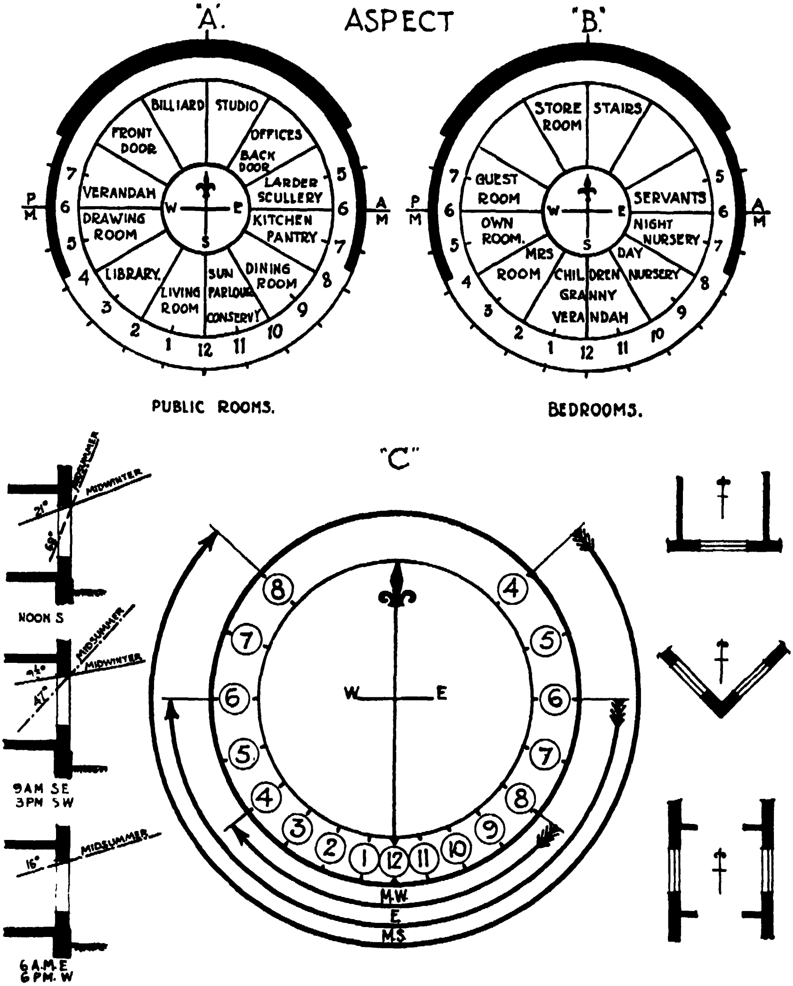

FIG. 120. Sunshine in the house.

children's rooms must get plenty of sun, but not at 4.0 a.m. on summer mornings, or they will wake up too early and sing, and be cross by 3.0 p.m. And the spare room, which will be used least, may as well go to the north and have a bleak exposure, provided the outlook is not over the owner's or some one else's back-yard—and so each room is in turn considered.

Now the compromise begins. Every room cannot have the best view and the exposure most appropriate for its use. Some can, perhaps, and others are bound to these by organic functional relations and may get the good things too, or just miss them on that very account. And now the thing begins to take shape, and one has the ground floor laid out, and the slope of the land admits happily of a lot of good well-lit accommodation in the basement. So one lays that out tentatively and some things won't work, so one leaves them over, keeping a note of all the loose ends. And now it is time to lay out the first floor, on which the bedrooms are mostly located; and one finds that one can no longer devote one's whole attention to purpose, and the refinement of purpose, but must begin to think also of material and technique.

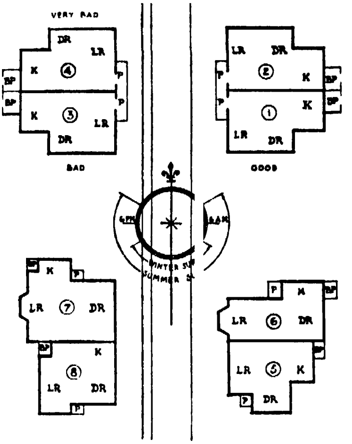

FIG. 121. The problem of aspect in semi-detached houses. 1. 2. 3. 4. Plans repeated regardless of aspect. 5. 6. 7. 8. Plans varied regardless of prospect.

7. *Materialization*

The solution in space has to be made to fit with the solution in bricks and mortar and joists of economic size. The first floor has to be carried by the ground-floor walls and must in turn carry (and perhaps be partly contained in) the roof. The roof is to be of slate and must be so pitched as to deal adequately with rain and perhaps snow; if there is going to be much snow the shape of the roof becomes very dominantly important.

But in all this sudden confusion of new subordinate problems, if one has followed a logical procedure so far one knows just where one is. Part of the arrangement won't work for material, or technical reasons; then it must be changed and, if one can't change it a little, one may have to change several things quite a lot. But one is by this time master of the requirements and their relations, one to another, and need not get carried away out of sight exploring over new horizons. If there is a serious crux one must follow the late Mr. Hessell Tiltman's favourite instruction: 'If you can't find a way, make one!' One should be quite happy and fatalistic about it. *There is always a solution.*

It is a case of retracing some steps of the argument as far as one must, but no farther than one can help. There it is! There was bad judgement in a small matter. They can't have their living-room chimney at the end of the room; it goes at the side. Now one can get on upstairs where the difficulty was, and the roof will be all right too. Eureka—solution and synthesis. And so the thing grows, and, if one has to consult one's client about alternative arrangements here and there, one at least knows what they are *and what they imply*; and that is the business of a designer or architect.

So now the whole thing hangs together and the heights of the walls and the slopes of the roof and the position of the main ridge and of subordinate ridges and gable ends and chimneys establish themselves. One begins to see what the little house is going to look like and might, if pressed to do so, make a rough sketch for the information of any one else who is interested.

The process is still far from complete, but one has discovered the general form—the main implications of these requirements for that particular site, embodied in the selected materials, wrought in accordance with their several natures. By setting out sections one can find out quite a lot more about the discovery—not all to one's liking perhaps. Then with dimensions in length, breadth, and height broadly determined it is time, perhaps, to set up elevations, inside and out, and to study the form by projection in perspective, as seen from certain points of view. But that sort of thing is outside the scope allotted to the present chapter.

8. *Designing from the Wrong End*

It will be more useful for an understanding of the issues here under consideration, if, instead of letting our impersonal architect complete the design in detail with its windows and their panes, and the chimneys with their tops, we proceed to inquire where he would have got to had he proceeded otherwise. What would happen if he had begun by making a mental image, or a perspective sketch of the little house, and had then proceeded to pack the required contents into it. The likelihood of getting a plan that would satisfy the conditions and requirements would in that case have been negligible. The chances would have been about as good as those for a collision between two stars.

'But', it may be argued, 'an experienced specialist would not have to take all those steps. He would have known from the start what the form would be.' Well, he might jump a step, or two, here and there. If he had solved very similar problems many, many times, he might even jump several; but that does not mean that he would not have to tread each, but only that he had done so already and therefore did not need to tread them again.

The besetting sin of all young designers, and many old ones too, is to jump at conclusions by allowing themselves to visualize, or imagine, or even draw their little house as soon as possible after they know they are going to work it out. In doing this they are relying on all their past experience of little houses, which may be very little, or quite a lot, but is not necessarily all applicable to the case in point. Then, having made up their *minds*, not *how* their little house is going to *look* (that can only be found out by designing it step by step), but *what* it is going to *look like*, they proceed to elaborate it in detail of plan and construction. They then inevitably begin to distort and derange the premature image they have conceived. If, by keeping at it, they do eventually get a habitable house out of it at all, they will certainly have lost much time, and almost as certainly have missed the proper organization of the several parts of which the whole is made up. Quite certainly they will have arrived at some compromise form, very different from the image they started out with.

9. *Evolution*

The technique of designing such highly organic things as little houses is not unlike the technique of Nature. The little house has its ancestors, all modified by their ways of life in their several environments. Thus a great many little houses, built in the last four thousand years, have a say in any little house designed to-day. That say manifests itself partly through selection, as when one's little house is influenced by the other little houses one knows about from the outside only, yet assumes to have been good little houses inside. But that say is far more potent through the social experience which determined how people have lived in little houses. That experience, which belongs to society at large, is what really determines the programme of requirements or list of rooms, their sizes, for their several uses, and, most of all, their relations each to each. This determination is very like the relations in a tree, or a cat, between its several limbs and its internal organs, with respect to structure and interior economy. The outside of the tree, that a landscape painter paints, and the outside of a cat, that an animal sculptor models, are determined by the inside of the tree in the one case and by the inside of the cat in the other. A representative artist cannot deal with the outside of either intelligently unless he knows a good deal about the inside, it is true; but he deals with external appearance.

The designer is in an altogether different position. He may be as interested in the appearance of the outside of his little house as the painter is in that of his tree, or the sculptor in that of his cat, but in a quite different way. For he designs and, in a sense, creates the appearance, discovering the form of his thing, while they are busy apprehending and appreciating form discovered or created by other agency.

Now the mental process of discovering the form of the little house, taken as an example, is the mental process for all design, be the subject a dog-kennel or a palace, a canoe or a liner, a spoon or a steam-engine, a sock or a coronation robe. First the enumeration of the organic parts, second the determination of their dimensions, third the investigation of their relations among themselves, fourth their arrangement. This last connotes and implies a due respect for external considerations, as well as those arising within the organism of the object. When all this is accomplished, purpose is under mental control, and materialization, in its double aspect of stuff and method, then comes into play. The problem, whatever it is, can now be solved and form results.

The form thus arrived at will be imperfect precisely by the measure of its failure in synthesis. Such failure is nearly always due to faulty procedure—that is to say to disorderly thinking engendering a wrong assembly of premisses—rather than to a faulty deduction from the premisses assembled.

'But where', it may be asked, 'does the art come in? Surely this is just engineering.' To the last observation we may answer, 'Yes and no'. It is just space and traffic engineering. As the problem selected for the illustration of the mental process of planning was a house, and as good planning is the basis of the architect's claim to professional status, we may say, of course, that we have engaged in an architectural, rather than an engineering, exercise; but that is only a name.

Of architecture as an art something will be said later on; and various architectonic phenomena have already been referred to in earlier chapters. But not to leave the matter entirely at a loose end at this juncture a few remarks on the subject may be in order.

10. *The Completion of the Design*

The solution of a problem was brought to the point where the positions and dimensions of all walls, openings in walls, roof surfaces, and chimneys were determined, not necessarily finally, but at least consistently. What still remains to be done may be designated as composition. The little house is already composed in the broad general sense of the word, but in the more technical sense we have not yet spent a moment on 'composition'; we have made no determination of its scale and its proportion, beyond ascertaining the crude dimensions on which these must be based. Neither have we as yet considered any optical illusions that may arise from the disposition of the several parts—whether remediable, or to be made the best of. We have not yet given thought to the functional modification of its several structural elements, and we have so far ignored any sentimental, or cultural, preoccupations and proclivities either of the owners, the users, or the builders of the little house. And, most important of all, we have thus far ignored all question of the mood—sad, mad, or glad—with which the architect, as artist, has it in his power to invest a child of his imagination, through his way of dealing with all these hedonic and expressional matters just mentioned. This is where the art comes in; not in the plot but in the telling of the story.

At this stage of the inquiry it is sufficient to have given due emphasis to the absolute need of a logical consecutive process in elaborating the plot or plan. This may have many and great artistic possibilities, or they may be few and of little consequence, but, in either case, it is equally imperative that they arise out of the plot or plan and not fortuitously. Inspiration comes from the theme, not from the sky.

XVIII

EVOLUTION AND GROWTH

1. *Evolution*

SINCE the planning of domestic work, when properly done, makes a greater call on the ingenuity of the designer than that of any other class, and since, in a general practical way, it usually provides the training ground for the planner of all other kinds of buildings, some further attention must be given to domestic problems. The historical evolution of the house need not be gone into; but some consideration of the simplest and of the more highly developed manifestations of current domestic problems is here required. These all manifest the same basic elements; and it is the elaboration of these elements from their simplest to their more complex forms which may be regarded as exemplifying evolution, even when time and sequence are ignored. What we are considering is an evolution of the things to be taken account of when following the steps already described, with due reference to size and cost.

The elements are the same for a cabin in the woods and for a palace. They can be named in their order of practical importance—a place to sleep in, a place to cook in, a place to eat in, one to be at ease in, and, possibly, a place aloof to ruminate in. All these places may be within one cell or room, and each and every one of them may be elaborated into a group of cells or rooms, but they are always there in a house. The place to ruminate in may be a doorstep, or a suite of rooms designated 'the library', 'the study', 'the studio', and so on. The place to cook in may be 10 square feet of floor space with a knock-down stove in a corner of it and a pail standing near by, or it may consist of a kitchen, a scullery, two or three pantries, a larder, a dairy, and all sorts of 'offices' attached to the kitchen group. But as good a meal can be prepared in the one as in the other, if one knows how, and the imagination can work as freely on a doorstep as in a private library.

All this being made clear, some further remarks on scale in relation to use may be made in amplification of what was said in an earlier chapter. The least that can be got along with, having in mind the size of grown-up people, can be found exemplified in Pullman cars and cruising yachts and caravans. These are in a sense movable habitations. They are characterized by the need to keep the boat or vehicle small enough for its main functions as a means of transport, and in them convenience is secondary.

In dealing with accommodation contrived on a fixed location—tents are merely a case of transport accommodation detachable from the vehicle—a more commodious scale is demanded. Doors 20 in. wide and bunks 24 in. wide no longer suffice for protracted habitational use. Heights vary less than widths in the progress from cabin to palace; while some dimensions are so closely related to the size of men and women that they do not vary at all, or vary only slightly. Window-sill heights and table and chair heights are thus fixed within very narrow limits. Ceiling heights vary more than door heights, being largely determined by the relation of window-head height to the floor area of the room in the interest of daylight, while door heights retain a close relation to human stature. But door widths vary considerably, being determined by traffic problems. Do people enter singly or in couples, or in groups? Must large furniture be passed through occasionally?

Then again, steps and stair flights and staircases vary, not only in connexion with the dignity of the habitation, but in close relation to use. The 'going' of stairs is practically constant, a relation of tread to riser, determined by the average pace of average people. Whether we take the 24-in. rule (1 tread+2 risers = 24 in.) or the 66-in. rule (tread × riser = 66 in.) we get a very similar result. A short stair, to cover an 8 ft. 6 in. floor to floor height, in a cottage, may have risers 8 in. high, but a long stair in a large country house to cover a floor height of 16 ft. would be very fatiguing if the rise were over 6½ in.; yet the 'going' might be the same. The widths of stairs and of passages are governed by considerations very similar to those affecting the width of doorways; both on stairs and in passages account has usually to be taken of persons going both ways and meeting and passing.

Enough has been said to show that, quite apart from the number of inhabitants in a house and the consequent number of bedrooms, the various scales of living and entertaining affect the sizes of parts with only a relative consistency; for some kinds of parts do not vary at all, others only slightly, and still others within a wide range. A cottage living-room floor, cleared for four people to dance the reel of Tulloch, and a ball-room for eighty couples to waltz in, exemplify the wider range.

2. *Simplification of Subdivision*

Passing on to the consideration of the subdivision of available space one may note that in the cabin of a cruising yacht the bunks may serve as the seats for use at meal-time when the table over the centre-board is set up. In the one-room hut, or cabin, all the functions of living happily may be conducted by a judicious arrangement of furniture and equipment. But taking the small house, already studied in some detail in the last chapter, and, working down to the one-room cabin and up to the great man's house, let us note what partitions can be dispensed with in the one case, and what additional subdivisions of space may be appropriate to the general expansion in the other. The bedrooms need not occupy us long; the public health acts of civilized countries usually provide for the minimum cubic contents of habitable rooms for one, and for two, persons. While these enactments may be appropriate for urban dwellings, they are often excessive when applied to country dwellings as well. The theory that every one from babyhood is entitled to a room of their own may be dismissed as not economically practicable for more than 5 per cent. of the population of advanced countries. The question as to whether married couples should occupy one room, or two, is a matter of economics in most cases and one of personal predilection in the remainder.

It is in what are sometimes classed as the public rooms and in the service rooms that subdivision varies most. Take the public rooms first, for their use determines to a large extent the subdivision in both these groups.

As hinted in the last chapter, the living-room, especially if made long and narrow, may well serve the purposes of a dining-place at one end and a study at the other, an elastic and perfectly practical arrangement. With further simplification the hall, off which the stair goes up, can also be merged in this versatile cell; in which case the lower flight of the stair will occur within it. There is now a living-room in the true sense of the name. Turning next to the kitchen group, which in our small house had a pantry between it and the dining-room and a larder on the other side, near the back door connexion, one may note that all these three rooms can be merged in one. The kitchen in the little house would have a sink and a range, or gas-stove, besides tables and dressers. When pantry, kitchen, and larder are combined in one, as in so many small houses and flats, the functions of the pantry and of the larder are discharged by a fitting for dishes and certain prepared foods, and by a food cupboard, or refrigerator. One sink will then have to serve for dishes, pots and pans, and the preparation of food.

The next step in simplification is to combine the living-room and kitchen elements into a kitchen-living-room. A back door, from the kitchen end of the combined room, and front door, from the living-room end, each with something in the way of a porch and possibly a covered gallery or small piazza, are both still desirable; not both essential. The house now divides itself into two elements, the kitchen-living-room and the sleeping quarters. It may be assumed that in such a house there will be no servant and that one bathroom will do for all its inhabitants. Cupboards for clothes and some rough storage space are still necessary. In climates, or environments, where a basement with some form of central heating generated therein are necessary, the rough storage is easily taken care of below; or a mere fuel shed may serve. What in a large house would be the housemaid's closet is now a corner where a couple of brooms stand, with a nail on the wall hard by for the dustpan and brush. In the small house the laundry was in the basement; in this much smaller house it is just a tub made in one piece with the kitchen sink. And so on all through; everything is there, but in reduced and simplified form. And, needless to add, where every square inch counts and multiple use is made, not only of the one kitchen-living-room but of the several parts of it at different times of day, the most careful planning is necessary. The housewife should, for example, be able to take anything off the range, or the cooking table, or from the sink, and transfer it to any other of these pieces of equipment with a half-turn and a short pace.

The next step towards simplicity leads to what in Scotland is called a 'butt and a ben'; that is, a two-room house, one, the smaller, being the bedroom, and the other serving as kitchen-living-room, and often as bedroom too, with the bed in a recess. By this time the bathroom has disappeared, while an earth-closet out of doors, a tub before the fire, and a basin on a table combine to take its place. And now the only further simplification possible is to put 'all' the rooms in one room and 'the rest' out of doors, as in the backwoods cabin.

3. *Complication of Subdivision*

On the other hand, one may elaborate the accommodation described for the small house so as to serve some of the complications of life as lived by the 3 per cent. of the population who, for one reason or another, require big houses. There is no need to confuse the issues by asking whether the accommodation is provided in detached houses, semi-detached houses, terrace houses, flats, or de luxe two-story studio apartments, but confine ourselves to the requirements and their implications.

The bedroom accommodation can again be disposed of shortly; the tendency in such cases will be for bedrooms to increase in size and to decrease in occupancy. Some may have dressing-rooms attached to them and some may be arrayed in suites of two, while the American hotel ideal of a bathroom for every bedroom gradually prevails as the general scale of accommodation ascends. A sprinkling of those very private public rooms, entitled boudoir or cabinet, among the bedrooms may also be demanded. The question of accommodating ladies' maids and nurses close to their charges and away from the other servants' accommodation may also arise. The separation of the sexes among the servants will probably have to be dealt with, if the establishment reaches such dimensions and dignity as to involve butlers and footmen. It may also be that a somewhat kindred problem among guests may find solution in a bachelors' wing.

Turning to the public rooms, one may note that, as the scale of living goes up, functional elaboration becomes more marked. Starting with the living-room, dining-room, and study of the small house, there may be not only general enlargement and multiplication, but a highly organic subdivision. The living-room may tend to absorption in the hall, which thus regains something of its ancient glory as the big room of the house, or at least as one of the big rooms. In the small house the hall had become a mere connecting link between front door, main stair, and other elements, but it now becomes the common meeting-room, preserving, while it does so, much of its character as a general connecting link. One or more drawing-rooms now appear for more formal entertaining than is involved by the daily afternoon tea; this is probably taken in the hall. These drawing-rooms may be thrown together for dancing, or there may be a ball-room. Again, one of them may be used for music, or there may be a music-room. A billiard-room with a recessed fire-place, or a deep bay, affording a casual lounging place, may also be wanted.

The study may now elaborate itself into a library, a study proper, and, if in the country, a gun-room. There may be a children's study in a place apart. Verandahs, conservatories, sun-rooms may further complicate the situation, and absorb the functions of some of the public rooms just named.

The dining-room may now become so large that it is uncomfortable when only the family are present; and a breakfast-room may appear; or compromise may be effected by breakfasting in a bay off the main dining-room. A separate children's dining-room may also be required, possibly far removed from the main dining-room. The servants' hall may be a general room for eating and sitting in, or a separate servants' sitting-room may be needed. The butler and the housekeeper, if such there be, may require places they can call their own. In the small house there was a kitchen, pantry, and larder, each within its own walls and partitions. Now the kitchen grows bigger, and there may be a pastry kitchen as a separate room. Pantries multiply— service pantry, butler's pantry, dish pantry, and so on. Pot washing and the rougher preparation of food may give occasion for one or more sculleries. With all this elaboration, storage places will have to grow in size and in number—wine-cellar, root-cellar, jam cupboard, dry store-room, dairy, meat-room, and such like, to say nothing of fuel stores of various kinds.

If the house under consideration can hardly any longer be describable as small, it may need one general man-servant in addition to the two, or three, women-servants, and he may be a versatile creature—gardener, furnace man, chauffeur, valet, butler on occasion, and odd-job man, all in one. As with increasing state these functions have to be divided, rooms for such several occupations become necessary. Then the laundry will grow and subdivide for a drying-room and ironing-room. There is no end to the possible complication of living in a house.

And so with the immediate outdoor life—gardens, vineries, garages, stables, byres. And on top of all this there is the question of general heating and, if the site be isolated, of water-supply.

4. *Proportions in Development*

Yet while all this organic elaboration goes on, so to speak, some things remain the same size as before. The door-handles remain 36 in. above the thresholds, and window-sills remain for the most part 20–30 in. above the floor levels; and so also with many other things, as already noted. Now this is very important artistically, though based in the practical. However big the house and whether compact or rambling, symmetrically disposed, or irregularly grouped about a dominant element, the maintenance of scale is largely a matter of making artistic use of the non-variable dimensions. Once scale is thus maintained it is possible to give scale by establishing contrast between the elements of fixed size and those which vary within the problem in question. The characteristic of size is usually well worth artistic exploitation in design, as was noted in the chapters on scale and proportion. The artist may interest himself chiefly in size (big or small) or in complexity (simple or manifold) or equally in both. In any case the expression of size and complexity both depend on a systematic interweaving of scale and function in the whole, in its parts, and in the parts of the parts.

What is true in this respect of great and small houses is also true of big and little ships. The little ship (or house) is not a miniature of the big ship (or house). In the main broad outline it may look so at a first glance, but size-revealing differences soon manifest themselves in sail-plan, masts, rigging, cabin decks, life-boats and so on in ships, and in the minor parts, above referred to, in houses.

A big house might be lengthened indefinitely to accommodate increase in the number of rooms. By adding stories for the same purpose its height might be increased; but only within more restricted limits. But the depth of the house could hardly be increased at all for the purpose of additional accommodation; for the depth is governed by the daylight problem. An enlargement of rooms with a raising of ceilings and window heads would, however, be compatible with an increase of depth front to back.

Thus the form of a two-hundred-room house cannot be an enlargement of the form of a twenty-room house, nor that an enlargement of the form of a two-room house. A seedling with four small leaves is a very different thing, from the point of view of design, from a plant with a thousand large leaves and fifty blooms. A baby and a grown man differ less, for each has the same organs, muscles, and bones, and yet they differ considerably in the proportionate dimensional development of these ingredient elements of structure. A baby is not in form a little man, though his mother may flatter him by that description.

5. *Growth*

It is time to give attention to a different kind of development peculiar to some other kinds of buildings and to certain kinds of furniture and equipment, but not, generally speaking, characteristic of the whole apparatus of life. This is growth by units as distinct from growth by organic complexity. In house problems this manifests itself chiefly with respect to the bedrooms. The following characteristic examples may be cited. The books in a library increase, let us say, 10 per cent. per annum and the readers 3 per cent. The staff to look after the books may only increase 1 per cent., while the staff to look after the readers increases 2 per cent., and the librarian who looks after books, readers, and staff need not multiply himself. He is quite sure, and probably right, that he could look after 100 times as many books, assistants, and readers if paid a higher salary. Or, the children in a school increase by 200, the teachers increase by 5, the head remains. Or, the looms in a mill increase by 1,000, the work-people by 180, the office staff by 3, and the manager holds his job. Or, the beds in a hospital increase by 75, the nurses by 18, the medical staff by 6, and the management not at all.

Now in all such cases, if the increase were sudden and in the order of a doubling, or trebling, the right thing to do might be to build an additional library, school, mill, or hospital with a complete organization of parts corresponding to the dimensional needs. On the other hand, if the increase is of, say, 20 per cent. and the building is obsolete, the question may be one to be answered by the scriptural advice: 'Pull down thy barns and build greater.' But if the building in question is not ripe for demolition and there is a question of a considerable unforeseen increase in books, children, looms, or patients, there will be an 'additions and alterations' job which taxes judgement and ingenuity to the utmost and usually gives a result little better than a new patch in an old garment.

6. *Unit Planning*

But in a case where the increase can be foreseen when the original library, school, mill, or hospital is being planned, a part of the original problem is this provision for the increase, when it becomes necessary. Obviously it will not pay to build a little every year or two, and only future structural additions of economic dimensions should be taken account of in the original scheme. To do this in such a way that the original building does not constitute a half-finished makeshift is not always easy. A rigorous use of the principle of *unit planning* will always be found helpful in such cases. The decision that a given building is to grow to a prescribed amount in a specific way, when taken into account from the start, becomes a conditional factor affecting the solution of its every element. This then engenders distinctive characteristics in the whole; even while that whole is only a part of what will be.

Suppose a hospital plan involving an administrative building, connecting by a long transverse corridor to six wards, to be erected at once; and that this corridor is to be susceptible of extension to reach three more wards at either end later, thus doubling the bed capacity. Provision must then be made in the original layout of the future extensions for a great many other organic elements in addition to the new wards. Few of these elements, however, may need double their original capacity, measured in cubic feet. Assuming that operating theatres occur off the corridor between the wards and that three are provided by the original building operation, one more may be amply sufficient. When the six new wards are added, twice as much linen, blankets, and supplies will have to be stored, mended, and washed. The storage for this item may have to be doubled, and likewise the area of the mending-room, but the laundry as a whole may only require to be increased by a half and some of the elements of the laundry by far less. Again, while twice as much food for patients will have to be dealt with, that does not mean that the kitchen and all its related offices will have to be doubled in size. There will be twice as many nurses to be taken care of, but not twice as many doctors. The administrative offices need perhaps only be increased 15 per cent., for it is just about as easy to add up sixes and eights as threes and fours and to order twenty tons as ten.

Now suppose the expectation is to add four wards in ten years' time and two more six years later. Then every element of the scheme which is not self-contained, like the other wards and operating theatres, must be so arranged that it can be added to, and not only that, but added to in the required amount as far as calculable.

Much of the non-proportionate additions can well be arranged for by displacement of other accommodation. Thus, if three branches of the administration occupy thirty *structural bay units* in the ratio 14 : 11 : 5 and their respective increases must be in the ratio 2 : 5 : 3, then there will ultimately be required forty structural bay units into which to redistribute the three branches.

Provided the structural bay units are appropriately proportioned in length, breadth, and height to their *average* function or use, they will be readily interchangeable and easy to add to. Unit planning demands a very careful investigation of the average unit function involved before determining dimensions. Over-specialization is to be avoided. Economic structural units may not always correspond to economic use units; some simple relation, such as two structural units to one functional unit, may be well worth finding. The first advantage of unit planning is elasticity in case of a not too radical change of use involving removal of partitions to throw two, or more, units together, or the addition of partitions to subdivide two- and three-unit areas; facility of extension is the second.

7. *Solutions*

If, in the foregoing remarks some practical technology has been dispensed respecting cottage homes, great houses, and hospitals, that has been by the way. The main object in view has been to introduce to the attention of the reader, more cogently than it was possible to do in the earlier theoretic chapters, the organic quality in all problems in design. This quality is nowhere more readily evident than in the plans of buildings. While it is true that there may as a rule be several solutions of a problem in planning, as distinct from the one solution of an algebraic equation, it may be remarked that the word solution does not mean any arrangement which provides for the incorporation of all the items of the programme of requirements under one roof. By solution is meant an arrangement which takes just account of all the relations of these items among themselves, and to the thing as a whole. In theory there is only one perfect solution; and in practice there may be the best solution offered, or ascertainable. Where there are several real solutions of equal merit this arises from the fact that planning is largely a matter of judgement as between alternative compromises. Every room could not have the best view and the best aspect; all the offices in an administration building cannot be next door to all others. Position must be judged relatively.

It may happen in any solution of a complex problem that, to attain good position for a certain element, one may have to sacrifice good position for another. Skill in planning is largely a matter of seeing clearly which are the elements not to suffer sacrifice in any way—of distinguishing between the essential, the important, and the non-essential. That means grasp of the problem as a whole; and this grasp is best assured by an orderly, and often laborious, procedure demanding concentration of a high order and rigorous control.

Those exquisitely simple solutions of complicated problems which the great masters of planning evolve, and which look as if they had just fallen on the paper ready-made from the sky, do sometimes come about in a brief moment of inspiration; but that moment does not come until or unless the problem has first been thoroughly assimilated in all its bearings.

XIX

ORGANIC PLANNING

1. *The Plan as an Expression*

A THOROUGHLY effective plan is not necessarily a work of art, but it must inevitably be an expression of the function of the thing planned. It may, as we shall see later, be a good deal more than that; perhaps this 'good deal more' is just Mrs. Browning's 'little more and how much it is'. It is not the theme of the plan, any more than it is the theme of the story, that makes its exposition in structure a work of art, but something in the handling of the theme. In this chapter we are still only dealing with the basic logic and grammar of planning.

Five highly specialized types of buildings will be employed for the demonstration of the organic principle with respect to these factors.

2. *Daylight in Building*

Fenestration is a very important part of architecture, but it is in reality an almost purely engineering problem. The uses for which the various parts of a building are designed determine the fenestration; for, in spite of all the great advances made in artificial lighting, windows still remain, and probably always will remain, the main device for light within doors. Now it is quite extraordinary how much crass ignorance prevails among owners, users, and designers of buildings as to the nature of daylight. The common assumptions are that about 10 per cent. of the floor area of a room will be the proper area for the windows of the room; that windows may be regarded as sources of illumination like lights, so that their light diminishes in intensity as the square of the distance from the glass; and, commonest error of all, that light suffuses space in the same way as a teaspoonful of tea suffuses water in a teapot. This leads to the erroneous conclusion that if the light outside of the windows is of a certain strength and the windows occupy a third of the outside wall of the room the strength of the light in the room will be a third of the light outside.

Light to see by is not something in space, but something travelling to the eye through space, either from a concentrated primary source—the sun, or a lamp—or from a bright object reflecting the image of that source, or from a more widely distributed secondary source such as the blue sky, diffusing clouds, or a white ceiling. In many cases all these kinds of light are involved together. The fact that the eye is so contrived that clear vision is possible within an enormous range of light, from one to many thousands of 'foot-candles', is the source of most of our illusions on the subject.

In arranging for daylight within a building it is flux of light from the sun, or less directly from the firmament, or the clouded sky that one is primarily concerned with. When the light falling on the book one is reading, or the work one is doing, is as low as one foot-candle, what is called the 'grumble point' has been reached. For easy working vision and the fullest differentiation of colour from 12 to 20 foot-candles is best. The planner's problem is to get light of this moderate strength on to tables where people work, or the walls where pictures are hung for inspection. But that is not enough; the exclusion of direct sunlight is often of great importance. If the field of vision contains even a spot of strong sunlight reflected from a shining object, or a strip of sunbeam on the floor or wall, the eye then adapts itself to this strong beam of light and ceases to function properly for the 12 to 20 foot-candle light which would otherwise be most convenient and agreeable, and which the planner may have been at pains to provide.

Then there is the question of the colour or tint of the light. Sunlight is variable, tending to yellow, orange, or even red, when the sun is low, especially when the light is filtered through smoky haze. North light from the clear sky is slightly blue; a well-balanced white light (revealing all colours fully) can be got by a mixture of clear sky light with some reflected midday sunlight, but best of all from a thinly clouded sky. Thus climate has much to do with the quality of light usually available.

Now a beam of direct sunlight traversing a room may be a very agreeable thing, both directly and by associations either simple or complex. Its hygienic value need not here be stressed. Such light has a very distinct place in the home and in the hospital. For reasons above given it is not a working light. How can one keep it out, where it is not wanted, while other light is required? If vertical windows are in question direct sunlight can only be kept out by so orienting the room that during working hours the sun does not show outside the windows; that is, by having an exterior wall facing north or north-east. If roof lighting can be resorted to a saw-tooth roof will answer with the glazed faces square to the north on plan, and set at an angle parallel to the direction of the midday midsummer sun at the latitude where the building occurs.[1] Where roof-lights for one reason or another must be of such a form that direct sunlight will penetrate all day long, or part of the day, the direct sunlight can be dealt with by screens and blinds. Some ingenious devices have been perfected in America with this end in view, the effect of which is to convert direct sunlight into what is practically diffused firmament lighting.

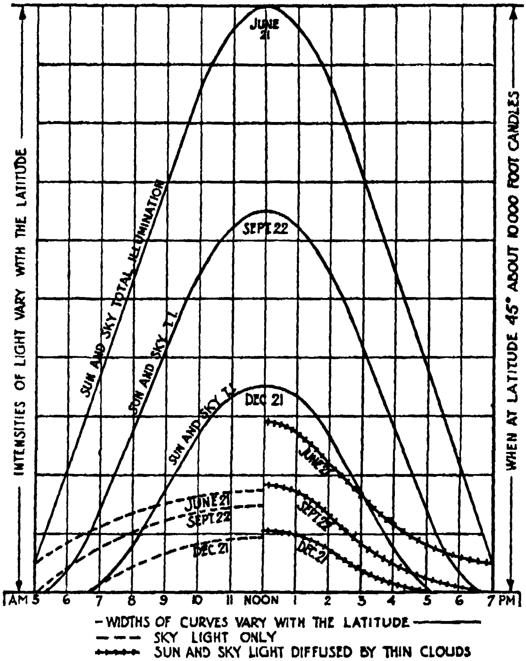

FIG. 122. Strength of sunlight and skylight throughout the day and the year.

Compiled from data in the Society of Illuminating Engineers' Transactions (American).

Henceforth the word sunlight will be used when direct sunlight is meant, and light when firmament lighting is meant. Out of doors when both are present at midday the sunlight is so much the stronger that the effect of the light from the sky is negligible, but when the sun is low they may approximate in strength though varying more pronouncedly in tint.

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[1] See Fig. 126 below.

Having caught the flux of light through window or roof-light, a great deal can be done to divert its direction to the place where it is wanted by the use of prism ribbed glass, usually set in an inner sash, or ceiling-light. Thus light may be brought a hundred feet down a shaft from a roof-light and be thrown against the walls of a room below by means of a ceiling-light, as is done with success in certain picture dealers' premises in the City of New York.

A word on the weather. North light on a cloudy day is usually stronger than north light on a clear day because the diffused sunlight from the clouds more than counterbalances the lost light from the blue sky beyond the clouds.

A window derives light only from such part of the sky as is unobstructed by the reveals of its head and jambs and by buildings, or other objects above its sill outside; hence the windows of lower floors facing on narrow streets with high buildings get little light, and what they do get is confined to a small area of the floor or even to the sill. At the best only half of the hemisphere of the firmament is available to light a window. Roof-lights are more efficient for their area. A double-pitched roof-light has, of course, the whole hemisphere of the firmament at its disposal and a weaver beam roof-light has at least the half-hemisphere, and that unobstructed.

Generally speaking, artificial lighting is not a factor of prime importance in planning. Most accommodation is planned for daylight, and it is for the lighting engineer to devise the best substitute he can. His main difficulty is to provide a flux of light without its source obtruding on the field of vision and thereby neutralizing his achievement. This difficulty he often neglects to overcome.

The plans of certain specialized types of buildings can now be studied after establishing what has to be seen in their interiors—work, things, or the interiors themselves. Form discovered on a drawing-board is not necessarily form discoverable through the eye of him who contemplates an executed work. The arrangement of the interior lighting has its bearing on things that are made to be seen. To be seen may indeed be the prime purpose of an interior.

The planning of libraries, fire stations, picture-galleries, and churches will be discussed in that order, restricting attention to those elements which are most distinctive and dominate the general solution.

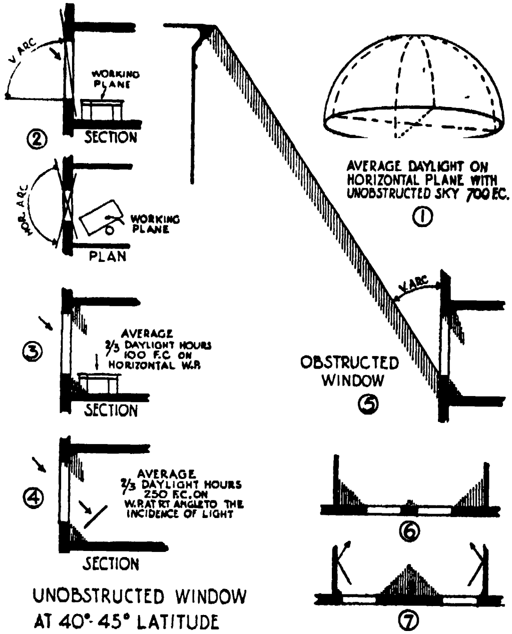

FIG. 123. Light from the sky entering windows.
Rough working average.

3. *Libraries*

A public library usually comprises the following elements: the storage of books in the stack, distribution of books by lending for removal, or for use on the premises (both requiring the borrowers' counters), the reading-room or rooms, and the management. This includes the receiving, cataloguing, withdrawal, and mending of books and placing them in the stack—all which we may call preparation, requiring working space directed to the actual distribution. The books, like food, come in by the back door and are prepared. The readers, like guests, come in at the front door and are served. The books and the readers meet at the counter as the food and the guests meet at the dining-table.

The arrangement of stack, counter, reading-room, and working space is further complicated by the question of economic supervision. Certain famous libraries with magnificent façades and very splendid reading-rooms are grossly extravagant in the matter of the staff required to run them. In some libraries it takes an unconscionable time to borrow a book—usually in those that are heavily staffed. In these particulars the all-round efficiency of the Carnegie Free Library in Edinburgh, designed by Sir George Washington Browne, may be favourably contrasted with that of the Public Library in Boston (Mass.) by McKim, Mead, and White. How much credit or blame attaches to the designers it is difficult to say. Each may have solved the problem, as presented to him, to perfection: yet skill in planning may do much to promote efficiency in administration and management.

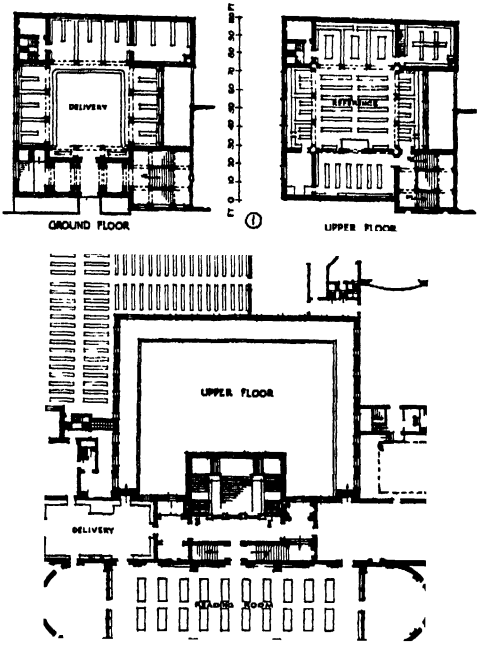

FIG. 124. 1. Carnegie Library, Edinburgh (Washington Browne).
2. Boston Public Library (McKim, Mead, and White).

A good test of any plan with regard to its practical efficiency is this. Can a person, with a sound knowledge of the routine of management with respect to which the plan is conceived, read it when set before him on paper with no designations for the several rooms? Can he imagine the whole thing in being and at work? The pellucidity of the Edinburgh plan is amazing, notwithstanding the very great difficulty of the site.

Book-stack area is a matter of simple calculation. The assistants can pass between the book-cases if their centres are from 4 ft. to 4 ft. 6 in. apart; their height must be such that a girl can reach to the top shelf; that admits of 8 shelves of normal-sized books; such books run about 8 to the foot of shelving. Book-cases are usually built in 4-ft. sections—the length suitable for a loaded hardwood shelf without undue sagging. Ranges of book-cases over 20 or 24 ft. long are inconvenient for several reasons and are too long to be well lit from the ends by daylight, in view of the low internal ceiling heights within the fabric of the stack. The central aisle must be wide enough for two persons to pass each other, each with an armful of books; and for one to pass where the short flights of steps occur from floor to floor of the stack. Wall aisles are very convenient and need be wide enough for one person only.

It is thus a matter of a few moments occupied in simple arithmetic to establish a ratio between square feet of floor and number of books for any practical width of stack, with or without side aisles. For any given case the length and number of stories in the stack can soon be determined once the number of books to be housed is stated. The fenestration of the stack can then be related to the book-cases, say at 4 ft. 6 in. centres, with the piers occurring opposite the book-case ends; but 9 ft. or 13 ft. 6 in. centres would do. The structural wall bay and the stack bay should be related, otherwise there will be uneven distribution of light. What is to be the relation—one to one, one to two, one to three? That depends on what the wall is made of, and how it is made—framed or not. It is not necessary to go into further detail, for the form of the stack is now seen to be a synthesis of purpose, material, and technique.

So with a reading-room. If windows can be got on both sides, or if ceiling light can be obtained, the readers may face one another. If the light is all from one side they will be more comfortable all facing one way with the windows on the left. There is not much difference in the amount of floor per reader either way. The length of the rows of readers will depend on the height of the window head, or vice versa. Twenty readers in a row would need a ceiling at about 24 ft. above the floor. The ceiling might be much lower with readers facing each other and their tables set across the room and lit from both sides of the room, or from above. But extravagance in height might be more than compensated for by lighting the room from one side only, in view of other economic considerations of the plan; and sunshine in the reading-room, where it is never wanted, might be avoidable if the room could be lit from the north or north-east only.

The borrowers' counter may now be considered. Its length depends on the number of attendants on one side and the number of borrowers on the other at rush hours. If it takes four minutes on the average, instead of one minute, to find a book asked for, there will be four times as many borrowers hanging about as there might be, and four times as many attendants all busy. The method of numbering, cataloguing, and placing the books that are most frequently called for thus affects the counter space.

The area for the borrowers' lobby is similarly affected. It is an expression of the answers to the joint questions: how many borrowers come in between 5 p.m. and 6 p.m., how long do they take to ascertain the correct name and number of the book they want, to find out whether it is in or not, and to get it from the counter? The system in vogue and the number of borrowers determine the area.

We need not investigate the calculations for area of all the parts of a library—there are several good books on the subject—but may now exemplify the planning process by looking into the arrangement of the parts, assuming these to have been fully enumerated and dimensioned. First, what are the traffic lines for a book? It is delivered in a box, heavy with other books, unpacked, and then dealt with in the catalogue room. Thence it goes to the stack and thence over the counter and back again till withdrawn through the cataloguing room for mending. Its entries and removals from the stack are recorded at the public catalogue adjoining the counter. The catalogue-room workers have thus much business at, or near, the counter, so there must be ready access.

Then there are the movements of the clientele. They come in to borrow and go out, and the less time they take about it the less space need be provided for their peregrinations; so the shorter the route the better. Or they come in, borrow at a different counter perhaps, sit down and read, return their books and go out. If the reading is serious they need quiet. There may be several classes of readers dealt with in different reading-rooms. The placing of these rooms—for children, for news-readers looking for vacant jobs, for magazine readers, for serious students—is important for each class. The relation of each of these rooms to the rest of the building will be determined largely by the answer to the question, 'What kind of readers use them?' but also by considerations of supervision. A small library with, say, 25,000 volumes and three moderate reading-rooms can, if well laid out, be fully supervised by one person behind the counter at quiet times of the day, although it may need as many as six attendants at the rush hour. If not well laid out in this respect it might need four attendants at slack time.

The library is a place where thousands of books are stored against the needs of a few hundred readers who, for the most part, come bustling in at certain times of the day and go bustling out again. They do not leave in a body as from a stadium or a theatre.

4. *Fire Stations*

Now consider fire stations, buildings in which there is no pronounced activity most of the time beyond shining up equipment and being on duty. But when the alarm goes, what a change! The men assemble, sliding down poles or doubling through doorways, buckling their belts as they come, then seize their helmets from the engine-room wall and jump to their places on long ladder, fire-engine, and hose-cart. If there are horses, a pull on one cord opens the great folding doors, drops their collars, and opens the duty stalls, and off they go to their positions, and a turn of the wrist completes their harnessing. The motor vehicles are always ready and a touch on a lever sets them in motion. The several pieces of equipment are out of the doors, with the men clambering to their places setting their chin-straps, and, as the wheels pass from the run-out to the street, the gongs begin their warning clatter.

Then, when the fire is all over, they return—reeking horses, men with grimed faces, vehicles with muddy wheels, and wet and damaged hose, and perhaps, here and there, a head in a bandage and an arm in a sling. But the engine-room is no place for all this mess. Cleaning up must be done in a yard, whence the vehicles, bright and shining again, go to their positions to await the next call.

In cases where the firemen live above the station, one watch in their homes and one watch on duty, the organization is very like that of a ship in certain respects. When this is so, the upper part of the building is an apartment house. The entrance to the stair is then through the engine-room past the duty-room door. Except when the trucks are returning, the back door is never open. The women and children pass swiftly and silently through the great glittering engine-room on their lawful occasions. The whole building is planned for a cataclysmic dramatic moment—the *get-away* of, say, three vehicles with their crews in seconds, not minutes.

To make this possible a great deal of consideration has to be given to the traffic routes in the building. These, needless to say, should be as short as possible and must not interfere with one another. The men on duty are in the engine-room, or hard by, or in the recreation-room. They man the first vehicle and are off by the time the others are pouring to their stations on the other vehicles. Evolution goes on rapidly in fire-station design. The substitution of motors for horse traction has involved many alterations in old engine-rooms and long ladder sheds. Better ways of doing things in a fire station and better ways of making gear and constructing accommodation are always being found. Improvements in doing things within the building affect the planning; and vice versa. There is a constant synthesis going on of purpose, material, and technique, resulting in form which we apprehend with the help of our eyes.

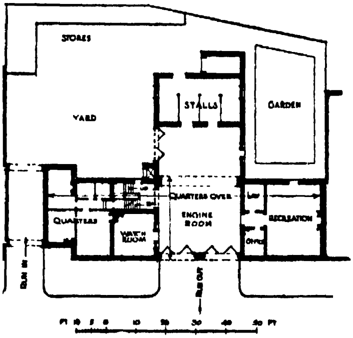

FIG. 125. Highbury Fire Station, London; 1905. (L.C.C. Architect.)

Before the days of telephones, the top of the hose-tower, where the hose are hung up to be dried, was used for a look-out and signal station from which to see the smoke of a fire and signal other look-outs of its location and magnitude. A red flag meant a general alarm. The tower remains as a characteristic adjunct of nearly all fire stations as hose are still dried in that way, but it has lost its patrol gallery with mast and yard. An atrophied organ, if you like. Man has not yet lost his once useful vermiform appendix, but he is losing it, and that is why it gives so much trouble; so would significant but unused flag-hoists on fire-towers.

A building with a tower, small-scale residential accommodation above, and the great portals of a large room at ground-level comes to be readily recognizable as a fire station. Most fire stations are more or less like that. These things come to be expressive of the cataclysmic moment above described, even to people who don't understand which window is which, and how a difference of practice or equipment explains and expresses itself on the outside of a building, as well as in the plan of the interior.

5. *Picture-Galleries*

Picture-galleries have something in common with libraries. They are storehouses to which people resort and they require a staff to deal with the contents and the visitors. But the stored objects are displayed to the utmost advantage instead of being stowed away in a stack with the utmost compactness consistent with their being readily found. Also the number of objects stored and the number of visitors are not of the same orders of magnitude as in libraries. In picture-galleries it is the lighting, not the dispatch of business, that is of paramount importance. Nobody is in a great hurry and everybody—except those charged with supervision—wants to see as well as possible. Only the public galleries and their arrangement need be dealt with here. The administration offices and work places present no outstanding peculiarities.

The prime necessity is to furnish an even flux of light of from 12 to 20 foot-candles on the vertical wall-faces extending from 12 ft. down to 3 ft. above the floor. If the direction of the light is such as to subtend an equal angle with the direction of the beholder's eye from any part of the picture surface, then the sky outside the window, or sky-light, is reflected by the glass or the varnish; on the other hand, should the flux of light come down too steeply against the picture surface, then the grain and texture of the painted canvas, or paper, reflects innumerable points of high light towards the eye and colour loses its depth; also the tiny shadows of the grain combined with these high lights reduce saturation towards broken tones. The even diffusion, the moderation, and the direction of the light are thus of high importance.

The next difficulty is the reflection in glass, or varnished surfaces, of bright objects such as light canvases and gold frames from an opposite wall, and particularly the reflection of persons with strong top-light falling on their heads and shoulders. The latter

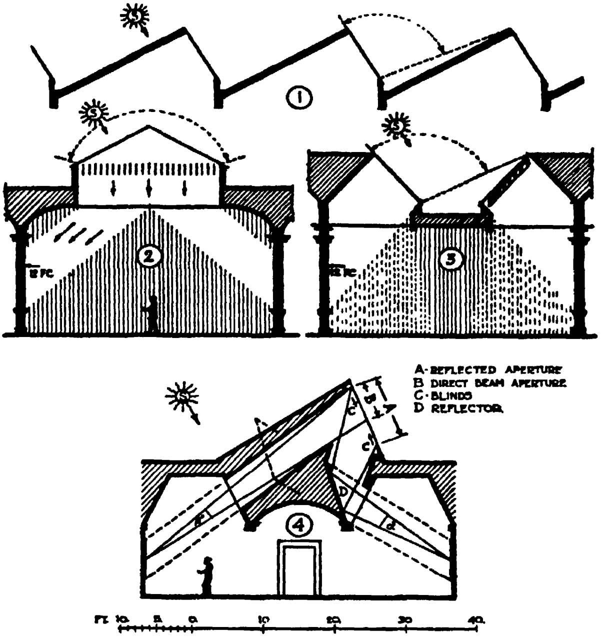

FIG. 126. 1. Sawtooth roof light facing N.
2. Filtered sunlight, Champeau method.
3. Top-side lighting, Seager method.
4. Direct and reflected N. light, Nobbs method.

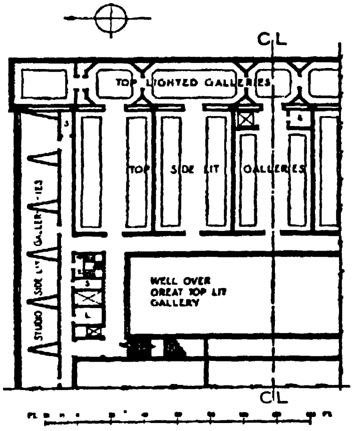

FIG. 127. Part plan for a picture-gallery with varied lighting systems.

difficulty can be partly overcome by reducing the top-light on the visitors till it is negligible as compared with the flux of light on the pictures. The only ways of dealing adequately with reflections from pictures on the wall opposite is to abolish the need for light on that wall by doing away with the pictures, or to set up a screen in the middle of the gallery, which amounts to the same thing. When one considers the quality of pictures as seen on a studio easel, or placed for inspection in the private room of a picture-dealer, the inevitable reduction of this quality in any picture-gallery and the far greater loss suffered when pictures are hung on the walls of rooms in houses, one must realize that perfection of gallery lighting is out of the question. Yet a great deal can be accomplished. As to pictures in houses, it is not too much to say that on the four walls of any room it is unusual to find more than one or two tolerably good spots for pictures—a really good place is rare indeed.

Now the collections of pictures are none of them very old, as the age of art is reckoned. The panel picture, as we know it, dates from the Renaissance. The early collections were made in great houses. The later ones were assembled in the suites of public rooms of disused palaces, and the earlier real picture-galleries (real in intention if not in effect) were architecturally grandiose suites of large rooms with hypethral lighting—that is, holes in the middle of ceilings. There is no more effective method of lighting solid objects out on the floor than this (so long as they are not enshrined in glass cases), but pictures are planes, usually placed vertically, on which objects are represented. To deal adequately with this essential difference between pictures and things, the modern picture-gallery has been evolved. As there is abundant technology on this subject the relative merits of the various systems in vogue need not be evaluated. Each has its advantages and its difficulties and its special suitability for different kinds of pictures.

And here is the really important point. There are many kinds and classes of pictures requiring not only different strengths of light, within the moderate range above mentioned, but also requiring to be seen from different distances. And not only this, but the eye as an instrument does not function at its best for long periods without a change of adaptation. The kind of standardized efficiency which strings a dozen great rooms together in a picture-gallery, each and all lit with a similar flux of light, defeats its own ends. People often wonder why a tour of a picture-gallery is so devastatingly exhausting. This monotony is a major reason and is as prevalent in some of the new galleries as in the old.

To design a picture-gallery to good advantage a fairly intimate knowledge of the classes of pictures to be dealt with is quite as necessary as a conversant knowledge of the strength and quality of the raw light outside. This differs greatly in Stockholm, London, Paris, and Rome, as also in Ottawa, Washington, and Mexico City. An understanding of how to deal with that light between the outer glass and the wall is the third essential.

As some extraordinarily successful results have been obtained by 'artificial daylight' in galleries, a word on this subject may not be out of place here. The difficulty is to convert the nearby source-light into a flux of light—to make light from a point near at hand behave as if it had come a long way. Individual picture lights as used in houses are of course no solution, as the top of the picture, lit from a source one foot away, will be sixteen times as strongly illuminated as the bottom, lit from, say, four feet away. Besides, the angle of incidence varies and the colour in the lower part of the picture is dulled by the high lights and shades of its texture, as above explained. Large individual pictures can be artificially lit with success by applying the principle of direct footlights all round the picture.

6. *Church Planning*

Among the problems of church planning, not the least is the lighting, but here it presents itself in a very different way from that just considered for picture-galleries. The most radical, iconoclastic atheist must admit that, given the problem of design involved in a place of public worship for a specific form and rite—redolent as such things are of a distinctive view of life—completely adequate solutions are far from uncommon. For it is not, perhaps, too much to say that the very best that architecture has to give has been abundantly bestowed in this connexion for the last five thousand years and more. Egypt, Greece, Rome, Byzantium, the Rhine Valley, the Île de France, the British Isles, Italy, Spain, Holy Russia, the Near and Far Easts, and the Western World all provide ample attestation of this; even if we discount 90 per cent. of all temples and churches as of no account artistically.

From the designer's point of view the expression of the ineffable grace of God may be just as much a problem for solution in structure as are the dissemination of such knowledge as can be packed between bindings, the setting of the stage for the moment of the fire-alarm, or the revelation of the products of the painter's art. In all alike, human convenience has a great place.

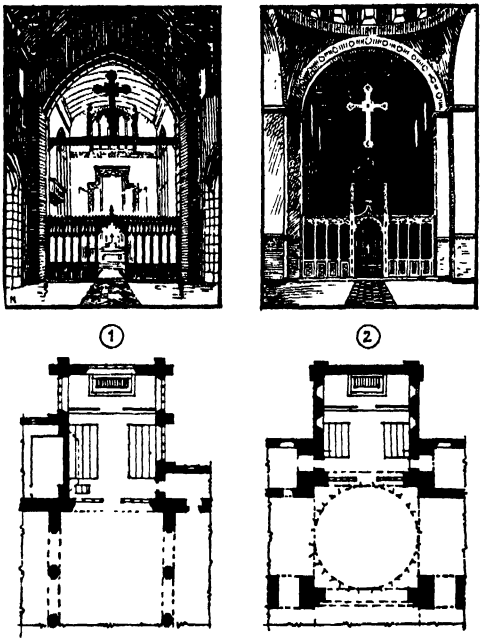

FIG. 128. Planning for effects of lighting.

In the church problem, whether it be a Shinto temple, a Roman Catholic cathedral, or a Presbyterian place of worship, there are always two classes of persons to be considered, the ministrants and the public, and there is always the rite or ceremonial to be taken account of. The spirits in which the ministrant and the public regard one another are enshrined in the rites. The physical requirements of the ministrants are met by providing for their ritual movements about the image, altar, communion table, pulpit, reading-desk, font, or whatever of these or of other apparatus of worship may be in order. The similar needs of the public usually require means for access singly, or in small groups, and for egress in a body, together with accommodation proportionate to their numbers, whether for kneeling, standing, or sitting, or for all three. These obvious needs require no further comment.

The point of view, or spirit of the rite, above referred to, will determine how far it is important for all within the building to see what is done at the altar, or to hear what is said in prayer, praise, or admonition. The success of the enterprise may depend on an unobstructed view of the altar, or upon the degree of comfort afforded by the seating, or it may not.

Having duly noted the requirements, calculated their spatial dimensions, considered their connexions, and arranged their disposition (much of which may have been already done a thousand years ago and become embodied in tradition), the designer proceeds, as in any less inspiring problem, to pull his plan together and find out how it is all going to look inside and out.

Let us ignore the exterior, remarking only that in no class of problem does the interior form more directly affect the exterior form. The interior of a church is usually a far more interesting affair than the exterior.

Whether, to accomplish the object in view, it is necessary for the designer to be a true believer in the cult, has often been argued with heat. A sincere sympathetic understanding and a modicum of erudition have on occasions amply sufficed. The interior of the fabric and the appurtenances of worship, however conceived, formed, and adorned, will 'waste their sweetness' if they 'blush unseen'. Their not being seen may be due, not to an absence of onlookers, but to an inadequacy of lighting. Inadequacy here needs qualification. It may not be a question of not enough light, but of not the right kind with respect to direction or diffusion. Without shade one can only apprehend silhouette due to colour difference; modelling is lost. Then there is the colour question—pigmentation of masonry, pigment on wall surfaces, stain and transmitted colour in glass.

What of the disposition of light with regard to its strength? Suppose the church is to be of the traditional Christian cruciform type, divisible longitudinally into nave, crossing, choir, and chancel. An east window facing the congregation will only be tolerable, even in a dull climate, if it is filled with heavily toned or richly coloured glass and further mitigated by a considerable flood of light from the chancel clerestory windows. If the chancel is to be dark and mysterious, small windows in the east end will only glare the more because of their limited size. Some strength in south side lighting, preferably high up, will, on the other hand, reveal all the intricacies of screen and stalls and reredos. Midday sunbeams pouring down upon the altar may not be lacking in symbolic value at the close of the morning service. If the choir and chancel are to be in low light, a contrasting flood of light at the crossing, catching the rood and screen, can be contrived; when light is derived from a lantern over the crossing, strong effects are readily obtained. The great practical advantage of relying on large transept windows is that they introduce light without the glare of the directly seen window occasioning ocular discomfort to the congregation. With glare in one's eyes one cannot appreciate the delicate lights and shades on a ribbed and vaulted roof, far less compose the mind to contemplate the Glory of God which that miracle of light and shade is intended to manifest. The nave can again best be lit from the clerestory and from the west window for similar reasons.

Once the light has come into the building it can be caught and reflected and diffused and thrown about by judicious planning, so that it will do most good with respect to the aim, be that reading of small print on India paper, or the cultivation of a specific mood of receptiveness, of contemplation, of ecstasy, or of praise of 'wonderful works'. Religion may be a glad thing, or sombre, and the associations of light and shade and colour are not the least among the means for enhancing its spiritual character. But a glare in the eye renders cunning workmanship, persuasive eloquence, and the enchantment of the 'holy organ rolling waves of sound on roof and floor' of little account.

In conclusion, a word is due on the use of colour in such an interior as has just been envisaged. Whether glass of a golden, greenish, or other tint, or of full gamut of colour has to be reckoned with, there should be a prevailing hue. Coloured glasses do not necessarily transmit light of the same colour as those seen in the glass. Some do, some do not—a matter of chemistry and physics. Memorial windows of incongruous colour-keys are a most frequent source of disturbance. Suppose that the glass gives a prevailing greenish-yellow light, which is not uncommon. A violet-blue ceiling dotted with stars and an Indian red or terra-cotta wall will then both show as dark and dirty. Perhaps the most lamentable conflict between window glass and paint on walls and ceiling ever provoked is to be found in the Sainte Chapelle in Paris. With grisaille and silver stain windows powerful colour schemes for wall and ceiling are sometimes in order, but where polychrome glass is in question a very conservative use of paint is advisable. A golden buff wash on wall surfaces, or a slight rustiness, native to the stone, may go far to hold an inconsistent set of windows together. The late Mr. Bodley's sparing use of sage and olive greens in contrast with broken reds was always successful. It is surprising sometimes to see what his greens and reds really are by the white light of day.

Notwithstanding Professor Prior's complaint about the 'tinsel of modern ecclesiology', gilding is, and always has been, a great and powerful means of emphasis when colour is invoked in the service of religion. In French Canada the gilding used to be done by the nuns—full well they knew its possibilities; and right well they laid it on and burnished it. Richly it glows in the temples of the mystic East. Gaily it gleamed in the holy places of the Pagan world, and, if it sometimes glitters too vividly on a Christian cathedral high altar, that is the fault of schismatics who broke the original glass, or of the parsimonious who have built new churches and await fortuitous spasms of memorial piety to enrich their windows. Stained glass, when cunningly devised, can give value to all and everything to which its tempered light can reach, gilding included. For the fullest and most accomplished use of gold one must look to the monuments of faith inspired by the Byzantine tradition. In these great churches windows are few and small and high, for the Mediterranean light is potent; their glare is masked by deep ingoings, for the construction was massive; but, once the light is brought within the fabric, how masterly is the play that is made with it.

As a last word on this subject of the use and disposition and modification of daylight for interior effects designed, not to see to work by, or to read by, or even to see pictures by, but to reveal the fabric and its adornments, it may be observed that from the days of the Pharaohs to the days of the Tudors this has generally been well understood. In our own time Messel and Ludwig Hoffman and Bentley have really grasped the possibilities; but in modern practice, generally speaking, the control of light ranks as a lost art.

XX

GROUP PLANNING

1. *Heterogeneous Groups*

WHEN a planning problem comprises a number of buildings, instead of a number of rooms in a building, it may be presumed that there are organic relationships of some kind among them. Such relations are expressible in the grouping. They can only be ignored or denied at the price of inefficiency and extravagance. A meaningless abstract formalism may be imposed, of course, but that is not design in the sense here understood. In that case the form is not discovered, but borrowed from some other solution of some other problem of which it may indeed be a true expression, or else it is brain-spun but unwoven stuff.

The heterogeneous group will be considered first, the problems of the homogeneous group and the mixed group afterwards; and then some thought can be given to the apparently contradictory case of the group of self-contained elements, each comprising a number of rooms, all enveloped within one structural mass. In the problems now under consideration one is no longer dealing with the assemblage of cells within an organism of cells, but with the assemblage of the organisms themselves.

To proceed with the investigation of the heterogeneous group problem for an open site, stress must first be laid on the great importance of a thorough appreciation of the possibilities of the general site in the matter of topography, prospect, and aspect. The prospect for many parts of the scheme may have to be provided out of the solution itself. Group planning is almost wholly a matter of determining the individual sites for the various elements of the scheme in relation to one another and in relation to the general site.

In a heterogeneous group there is usually a dominant element—something to get hold of and to which all other members of the group can be organically subordinated. The dominance may be due to mere size, or to some matter of functional importance. Castles have their keeps, monastic establishments have their abbeys, colleges have their chapels, universities have their convocational halls, and all sorts of institutions have their central administrations.

It frequently happens that large institutions, such as universities, may have several elements, dominant in different ways, each with organic relations—whether wires and pipes or traffic routes makes no difference in principle, as both should be as short as possible.

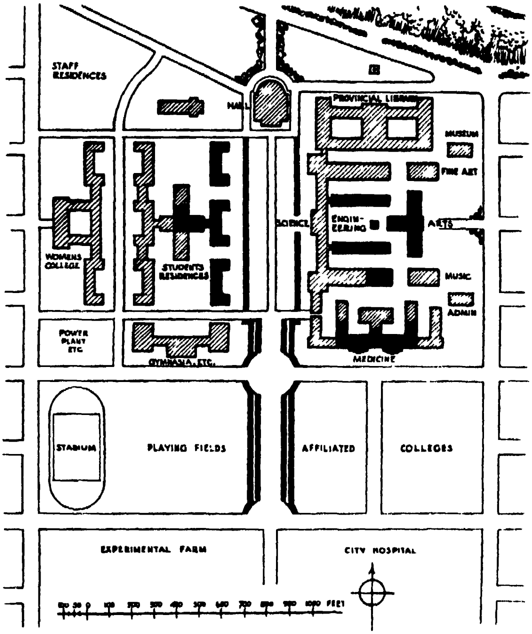

FIG. 129. The general plan for the University of Alberta.

For example, twenty buildings may be symbolically related to a meeting-hall, and practically related to a parent faculty, and intimately related to a general library, and administratively related to a central office, and physically connected with a central heating plant.

It does not follow that the hall, parent faculty, library, office, and heating plant should be packed into one central building. Each may have a far better separate place assignable to it; and keeping these elements apart may be an essential requirement. But in such a case there may be comparative importances of various kinds to take into consideration; these all reduce themselves ultimately to organic relationships. One cannot change the location of one

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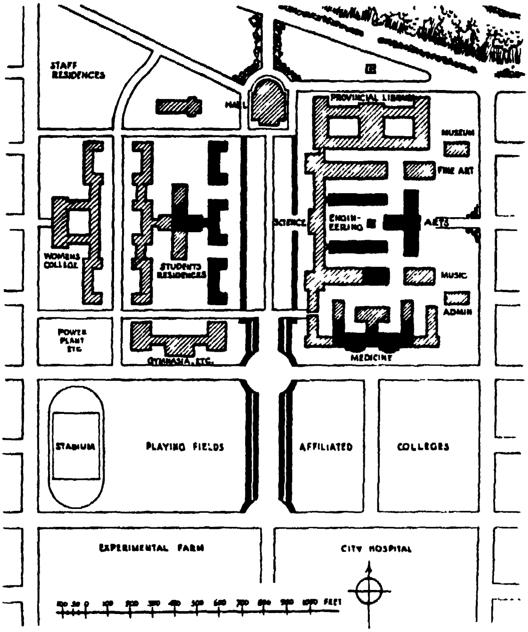

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Assuming, then, that by the exercise of a selective judgement one has determined on the location of the really dominant element in the case in hand, and has disposed of those other elements, which have general organic dominance of different kinds, in possible locations, it is time to look into the relationships among the twenty-odd buildings in the programme. Some may be found to have specific relations only with certain of the dominant elements provisionally disposed of; others may have close relations to one, or more, of the rest of the twenty. One thus discovers subordinate groups; these subordinate groups may turn out to be important enough for the honour of a 'subordinate dominant'; or they may occur in approximate pairs. If they do, paired sites can probably be found for them and some symmetrical disposition of these groups is organically indicated. If a pair of large subordinate groups emerge, the question of their disposition with respect to the main dominant element may be pursued. Thus one may find the raw material for a grand axial plan. But we must cease to pursue this particular possibility for the present, for we are not yet dealing with composition in the architectonic sense.

2. *Homogeneous Groups*

The search for dominant elements in heterogeneous groups is generally only a matter of deciding as between rival claims. The absence of such claims is one of the difficulties of the homogeneous group, as found exemplified in so many housing schemes. The problem may involve the location of from a dozen to a thousand habitations with no very marked diversities in the scale of their accommodation, and all greatly restricted as to type. In such a case it is idle to look within the requirements of the buildings for dominant elements. They all have the same relation to one another and that relation is one of mutual exclusiveness, except in so far as there may be community of interest in common land (set aside for the recreational requirements of children and adults), common

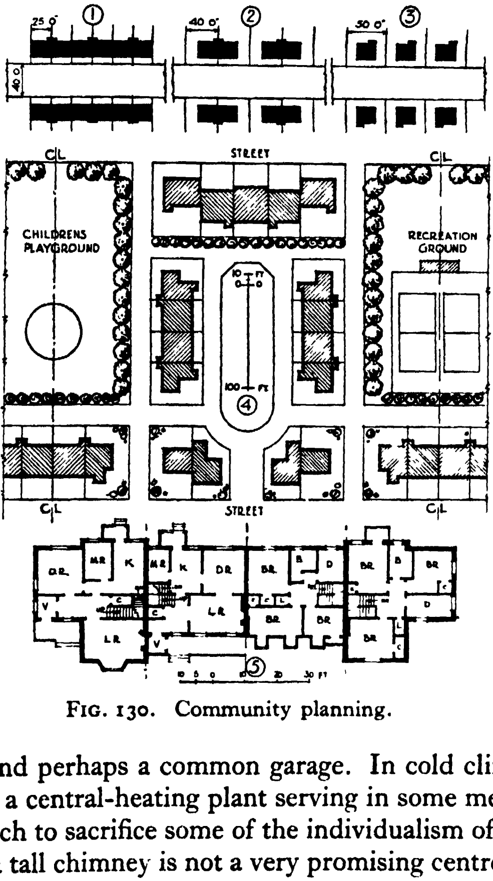


FIG. 130. Community planning.

roadways, and perhaps a common garage. In cold climates there may also be a central-heating plant serving in some measure as an altar on which to sacrifice some of the individualism of hearth and home; but a tall chimney is not a very promising centre of interest for a group of cottages. Of course, if the scheme be large, there may be the question of churches and schools and a community hall and so on, but in that case it is no longer a homogeneous group problem that we are dealing with, for it would partake of the nature of the heterogeneous group, or be a mixed problem.

To proceed then, there are to be, say a hundred or more very similar elements in the group. The plan will not be organically sound if it result in a development that does not have this homogeneity written all over it, so to speak. But this does not mean that the houses must be in close rows, each row, precisely of a kind, on parallel streets. The objection to that arrangement is that it takes no account of aspect or of the diversified traffic needs of the inhabitants, or of recreational facilities. A gridiron street plan and a tooth-comb subdivision of property into lots is not, humanly speaking, economic. The kind of pattern—and pattern is a good word here, for there is bound to be a good deal of repetition in the plan—will depend largely on the number of persons per acre to be accommodated, and that is probably not within the designer's control, depending as it does on land values, cost of construction, taxation, rental value, and so on. These and such-like considerations are among the basic factors of the design.

How does one proceed? The land may be as flat as a pancake and featureless, or there may be slopes and streams to help one. Arterial traffic to and from and, perhaps, through the land in question is almost certainly involved. Traffic of strictly local significance, for the service of the inhabitants of this, or that, part of the scheme is a distinct element, to be related to arterial traffic in a strictly limited way. The valley and the stream, if such there be, may determine the traffic routes of both kinds and, in conjunction with these features, may offer suitable areas for recreational purposes. Now the thing begins to take shape. The nearest shopping street, the nearest railway station, the nearest school, church, and cinema, all have a further bearing on the direction of the roadways, or, at least, on the direction of their ends. It is now time to see how much building land one has to divide among the houses; and whether the roads are so spaced as to admit of strips of land of suitable width between them, and so placed also as to provide a maximum of frontage—not necessarily road frontage—to the east, south, and west, and a minimum to the bleak north, if the place is in the northern hemisphere at a latitude where indoor sunshine is a thing to court, not to avoid.

It was said above that the houses need not be in close street-long rows. Nor need they all be detached. They are presumed to be small—otherwise they would hardly be likely to be homogeneous in type—and small houses can be well lighted from two opposite sides: say anything up to six-room houses from two sides and seven- and eight-room houses from three. Now it is an extravagance in any climate to build four outside walls where two such walls will serve, and in cold climates this extravagance is aggravated by heat losses. Semi-detached pairs of houses are no solution. When such pairs face one another prospect is apt to run counter to aspect for 75 per cent. of them. If one of them is well disposed as to interior planning with respect to aspect (and the two pairs are alike, each pair containing reverse plans) then with respect to aspect the reverse of the well-planned house will be ill disposed, the obverse and the inverse plans will be the one little better, and the other considerably worse than the ill-disposed one. Unsymmetrical pairs can, of course, be adroitly planned so that neither is very bad with respect to aspect, but in that case neither is likely to be very good.

By far the most convenient system is what may be called 'short-row' or 'small-group' planning—three, four, or five houses in a row, the end houses being lit from three sides. This leads to great elasticity in arrangement; especially when the minor or subordinate grouping is so thought out that there need be little if anything to choose between fronts and backs. The prospect for each house should be created by the group plan itself. The aspectual advantage of not having to face houses rigidly front to front and back to back is, of course, enormous. It should be possible (occasionally with the help of a bay-window perhaps) to get some winter sunshine into nearly every dining-room in the morning; and into nearly every living-room in the afternoon; and to get all bedrooms sunswept at some time of the day.

The problem is no longer how to find individual sites, but how to find minor group sites for our houses. That is to say, the blocks of buildings will be from 75 ft. to 120 ft. long, more or less, and these blocks can be grouped about minor open spaces big enough for tennis-courts or children's playgrounds. The pattern is not made up of polka dots of single houses, but of groups of short strips enclosing relatively wide common recreational spaces. The houses, if so arranged, are much pleasanter and more healthy to live in than if facing one another, cheek by jowl, in streets with back-yards behind. The private front gardens and private back-yards will probably have to be quite small in such a scheme, to allow for the community recreational space, but they are all the more likely to be kept tidy on that account.

The traffic plan within the minor groups presents several difficulties. Access for wheeled vehicles to both sides of a house is a convenience, but it is not a necessity. For example, where a road passes along the slope of a steep hill-side, both the kitchen or 'back' door and the main or 'front' door are of necessity on the road, for the houses below the road, and what can be planned in this respect for rich men's houses on a sloping site can be planned for poor men's houses on a level one. But with small houses the difficulty of doing this increases; and access from both sides of the small blocks under consideration is highly desirable. The roads need not, of course, be of equal importance on both sides, and garbage removal may be the sole function of one, all more exalted purposes being served by the other. The minor road may well be a one-way lane in this case.

In community planning the recreational open spaces are not, as already observed, the only matters in which joint action makes for amenity. Nowadays in many suburban areas a large majority of small householders own a motor-car. Great economy in construction costs and private road-making and maintenance can be effected by grouping the garage accommodation. Twenty or thirty cars kept at one fairly secluded point, in a tidy way, cause less noise and nuisance, for the twenty or thirty householders concerned, than a like number of cars housed separately. Economy apart, the accommodation can be better; and the disturbance of a neighbour's car returning late at night, with the consequent noise of slamming garage doors and stopping and starting of the engine for the turn-in, is completely avoided. In exchange for this it is no great hardship to have to walk a hundred yards to fetch one's car.

3. *Mixed Groups*

Such then are some of the main factors to be taken into account in group planning where the elements are homogeneous, as in a housing or garden-city residential scheme. In most cases where group planning is called for, parts of the scheme partake of the nature of the heterogeneous problem, first reviewed, and parts the nature of the homogeneous problem. This frequently opens the way to the expressive use of contrasting subordinate groups. For example, in the case of an industry situated far from a centre of population but in the vicinity of mineral or forest products or of water power, the mine, log boom, or power-house may form one element, the mill another, the offices a third, the railhead or dock a fourth, the residential quarters of the managing staff a fifth, the housing for the workmen and their families a sixth; and, duly related to these, there may be a school, a church, a hall, a club, places of amusement, and recreational grounds. A problem of this kind may almost be classed as one of town planning. We are supposing, however, that the whole place is owned by the company operating the plant, and that makes a great difference. The real town-planning problem, of which there will be more to say, begins when there are several separate owners, each with a say in the affairs of the community. The control is then quite different and the technique of progressive design infinitely more complex.

The owned mill town, or village, finds a counterpart in many government establishments, either of a temporary nature in connexion with great public works, or of a permanent character connected with such matters as dockyards and the like undertakings. This kind of problem is really as old as civilization. The Egyptians had to deal with it in connexion with the building of the pyramids, and every military camp, however temporary, has been a case in point. Genghis Khan and Cardinal Richelieu knew all about it. The exercise of control is at the root of the matter.

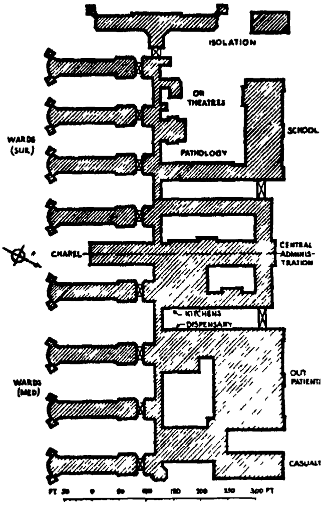


FIG. 131. King's College Hospital, Denmark Hill, London (W.A.Pite).

It should now be clear that the process of planning a great institution, or a speculative real estate development, or an industrial community, differs only in degree from that of planning a little house. There is the enumeration of the elements, the apportionment of their dimensions, the investigation of their mutual relations and connexions, their division into minor groupings, the appraisal of the relative importance of the groupings, and then the study of the site, leading to decision as to the location of certain elements in view of their functional character, and of the rest in view of their subordinate relations to these.

4. *Vertical Grouping*

Most of what has been said of group planning with respect to problems involving only moderate heights, but wide extension over the ground, is equally applicable to those problems of group planning where the horizontal extension is restricted and the vertical extension compensatingly extended. The tall apartment house, the great hotel, and the sky-scraping office building are cases in point. In such cases the apartment, flat, floor of bedrooms, or suite of offices takes the place of the departmental building or of the residential unit in the examples just considered. The traffic lines, which are an expression of certain functional relations of part to part, are solved by somewhat different means. Vehicular traffic is reserved for vertical travel and internal passages take the place of paths and lanes.

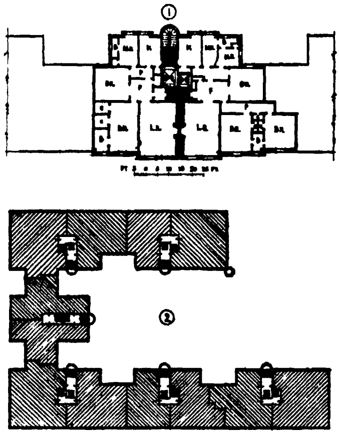


FIG. 132. Chateau Apartments, Montreal (Ross and McDonald).

This does not mean that a planner accustomed to deal with institutions, or model villages, or industrial plants is equipped with the technology to enable him to deal also with an office building or hotel problem. He will need a very different technology for that. But it is so easy in design to mistake technology for mental process. The designer who knows in what order to do his thinking —who is skilled in finding solutions—who understands how to set about the discovery of form—need have no qualms as to any special building technology. Of course, the acquisition of every particle of available knowledge having a bearing on the problem in hand is a very necessary part of a designer's duty to himself and to those he serves. Technology is not, however, the subject of this treatise, and is only mentioned now to make the point clear. It is on the principles and processes of design, as applicable to all and any sorts of things constituting the apparatus of life, that I am writing.

When dealing with a grouping problem the minor subdivisions of space must at the outset be taken for granted. One is not then devising the tactical scheme for a section making a trench raid, but an operation involving large formations, in which it is right to assume that every one in the sections knows his job and will do it. In this sense a group plan—involving heterogeneous or homogeneous elements, or both—remains fundamentally the same kind of problem, whether the site allows of a wide horizontal distribution, or compels a vertical superposition of the elements.

One might find alternative solutions for the requirements of a university on a 'campus' site and on a city block so restricted as to compel the top stories to reach the lower clouds. In either case the technology of the subject would remain the same, except in so far as vertical circulation was concerned; but the technology of the construction would be very different.

What all this amounts to is that the site for a building, or for a group of buildings, is really a part of the material. No matter how complex the problem, the resultant form is a mental boiling together of purpose, material, and technique. As in the making of a broth, the order in which the elements are put in the pot (or the brain-pan) has a great deal to do with the result. For a broth, the meat stock must be made first, the barley added at a later stage, the vegetables dealt with according to their kind, and the herbs put in last; but they all unite in the end. In these chapters on planning there is advice on the procedure most likely to lead to clarity of expression. One must avoid getting the barley reduced to a sour pulp, and the vegetables boiled out of recognition. The only way is by a disciplined procedure.

XXI

TOWN PLANNING

1. *Land*

TOWN planning begins when two property owners come to an understanding to respect one another's interests in the development of their properties. One may imagine a number of owners, each acting with mutual sweet reasonableness with respect to his two or more neighbours, and their heirs all getting into a horrible tangle by trying, still with sweet reasonableness, to understand just what their parents had in mind and then seeking to interpret the old understandings in terms of one another. The need in such connexions for custom, crystallized in law, will be obvious, even supposing all land and building owners were reasonable. But many of them are quite deficient in an ability to see a neighbour's point of view when their own interests are affected, though reasonable enough to agree in principle that sauce for the goose is sauce for the gander, and to submit to laws and regulations. So it came about that a certain fundamental principle was established and enunciated in Roman law—so to use one's property as not to prejudice a neighbour in the use of his. This happened long before the Christian era.

Now that principle is all very well up to a certain point. It will work if property owners are all gentlemen farmers, or all own pieces of land much larger in area than the houses built on them. But when for mutual defence, or business, or social facilities, people decide to live close and fill the roadside with their structures, it must be admitted that some will inevitably begin to tread on each other's toes, so to speak; for one cannot do anything on properties so developed that does not in some way affect the interests of one's neighbours, prejudicially or otherwise. So all-round mutual agreements are made in the form of by-laws and regulations, which have the effect of approving certain limited ways of prejudicing each other's uses of property.

One of the simplest and most natural ways for the community, or state, to assert its interest in the matter is by direct land taxation; this brings it home to the dullest property owner that he only holds his land on a rental basis from the social group to which he belongs for the specific purposes of protection against other communities, or states. But this kind of taxation, which is not popular among property owners, is not essential, for any taxes have the same effect so long as a man's immovable property can be seized for non-payment.

Property in land is thus not quite like other kinds of property. The owner cannot do with it just as he likes if he belongs to an organized community. In the last chapter it was observed that land was part of the material entering into the design of structures or groups of structures under one ownership. When the group is based on many ownerships the same is equally true.

2. *Town Growth*

A town may be said to have a natural plan in a case where no one ever sat down to think out its development and was energetic enough to get his views on the subject accepted. The old towns grew up where roads or rivers met, or where a river could be conveniently crossed, or where boats could find harbourage, or where a defensible position could be improved, or where several or all of these conditions were present. Many of these old towns have not changed much by growth in a thousand years, and have something of the quality of woods and shrubberies, where every tree and bush has grown into its position and form affected by its neighbours. So long as such towns do not exceed two or three thousand inhabitants, these are in some ways the best places in the world to live in. But if the town be destined to grow there soon comes a time when what is already there, in the way of streets and lanes and buildings and open places, begins to be in the way of the things that are wanted. A small town is not just an overgrown village, nor is a large town just an overgrown small town, in the sense that it cannot go on being that and go on living healthily. The organization of the several parts must have a relation to the size. A man weighing 180 pounds is not an agglomeration of eighteen 10-pound babies. He has the general scheme of one baby, but with harder bones and bigger arteries and a relatively smaller head and actually more tissue. With plenty of time at their disposal and an instinct for neighbourliness among its inhabitants, the little old town can be designed unconsciously by the joint effort of generations of townsmen. But between babyhood and adult development expert guidance is usually necessary, and with towns one never knows when they will stop growing. Thousands of towns that were expected to grow in America have not done so, and many of them never will, but all the towns still marked on the map of the world have grown, and very many are still growing. Of these a considerable proportion are growing rapidly and some very fast indeed. One need not here concern oneself with the sociological question of whether very big towns are desirable things. But one must give some attention to the phenomena of growth.

3. *Life of Structures*

The obsolescence and replacement of buildings is a matter of the utmost importance if one is to understand how far, and in what way, premeditative design can be carried out in the case of so complex an organism as a town, with continual growth to add to the difficulty. It will help if one regards buildings as a crop. How long, in a given climate, will buildings built in a given way last? How long, in a given community, will buildings continue to meet the needs and uses for which they were erected? How long, in a given location, will a building's use be appropriate to that location? These and a host of kindred corollary questions can only be answered, as a rule, in terms of one another, for they are all interdependent.

In Rome a stone house, with walls thick enough to keep the interior cool and with a tile roof maintained over it, will last a thousand years. In London a brick house, substantial enough to stand wind and weather, with a slate or lead roof maintained over it, will last three hundred years. In Montreal a stone and brick house, elaborated to be habitable at 20° below zero, with a tar and gravel roof kept in order over it, will last seventy-five years. A house ceases to last, in this sense, when it reaches such a condition that the maintenance costs are out of proportion to the revenue on the investment.

What about buildings continuing to serve their original uses? That depends on the rate of progress in the community and varies from time to time in any given place. One may say, however, that in Italy the kind of accommodation people in general required hardly changed between the fall of the Roman Empire and the beginning of the Great War; that in England there has been a slow but steadily increasing rate in the raising of general standards of living from the conquest in 1066 until to-day, when the accepted idea as to how an artisan should be accommodated is so different from what it was fifty years ago that the whole nation is in process of being re-housed, a situation partly due, of course, to increment in the population. In North America, where the standards have been generally lower than in England as to structural requirements but with notable development in mechanical conveniences and a very rapid increment in population, obsolescence is now reached in twenty-five years. All this is reflected in the character of Italian, English, and American slums. The Italian slum is at least a happy place, the English slum is depressing, the American slum is an utter abomination.

The third question dealt with location—the time it takes for a site to outgrow in value the buildings erected upon it. This depends on the rapidity of growth of the town; and the degree in which that growth is organically balanced. This in practice means the degree in which it is controlled. More will be said on this head presently when discussing zoning.

There are thus in any given case all sorts of matters related to structural life, social obsolescence, and change in land value which have to be taken into consideration with respect to the cropping of building land. This consideration is not primarily directed to the mere enrichment of the soil for a succeeding crop, but to arranging matters so that no crop need be cut, or rather pulled down, before it is ripe. There are many destructive animals walking the earth in boots and trousers, who gloat on the pulling down of buildings for replacement by others, without considering whether the community as a whole can afford the expense of building for fifty or a hundred years, and only getting twenty or forty years' use out of what has been built and paid for.

A devastating effect on the conservation of closely adjoining property values ensues when a building of totally different character, size, and use suddenly goes up in a more or less homogeneously developed area. That is another aspect of the matter which scientific zoning can deal with. For the moment the point to establish is that it is economically desirable to have structural, social, and site obsolescence concurrent—largely a matter of taking thought in good time.

The need of this is equally urgent, whether one is dealing with a complete new town site or, what is far more usual, designing for the conduct of a perennial city alteration job. This latter is what most town planning amounts to, and is what the new city problem soon becomes. A Versailles, a St. Petersburg, a Washington, or a Canberra must be regarded as the rare occasional exception which first only proves, but later on obeys, the general rule.

4. *Planning Legislation*

It is now time to say a word on the machinery of town planning. A Canadian expert has pithily described town planning as civil and political engineering. The political engineering is in virtue of the many-headed monster that is the joint client, or corporate building owner and, of course, far more difficult to convince of what is good for him than any individual client or building committee.

First of all, then, there cannot, except in the most unusual cases under autocratic impulsion, be any town planning without a basic act of some kind giving general powers and providing for a respectable procedure. Such basic acts are usually of an enabling character, empowering municipalities to do certain things in a certain way, so that the public may be protected against the grosser forms of exploitation and scandal, to which operations of a far-reaching kind on a large scale so readily lend themselves in an imperfect world. This protection is usually achieved by providing for long-term commissions which employ the necessary experts and report to the municipally elected bodies who, of course, must retain full control of expenditure. The due protection of the plan is an important element in such legislation. The elected municipal body may refuse approval, or delay execution, but what it has once approved must have the stability of law. The due protection of individual rights and interests through hearings is another important element in most such basic acts; and a regulated procedure for expropriation costs is usual.

5. *Commissions*

The work of the commissions under such a system is advisory. They produce reports and they prepare master plans, amplified with major street plans and detail plans later on as required; all which is the work of the experts employed by the commissioners. These studies are in due course submitted for the approval of the municipal authority. This, in practice, largely takes the form of by-laws and regulations for future building development, with designs for such public works as are involved—streets, bridges, parks, and occasionally structures.

6. *Surveys*

The first steps to be taken by a commission are the surveys. The topographical survey made by aid of aerial photography largely takes the place of the old ground surveys, which can never keep up with the pace of the development going on in the case of a large city with a population growing at fifty thousand a year. The aerial mosaic map taken as a preliminary step in the preparation of such surveys, while it does not show the levels which the fully developed survey may do with marvellous exactness, does reveal to the expert 'reader' the fullest information as to development up to the moment of the exposure. So much so that, when the survey for zoning information is begun, it is possible to 'read' from the photographic map with its shadows, enough information to arrive at round figures as to the number of people resident per acre, or to deduce with a very fair degree of accuracy the use to which the buildings are put—heavy industry, light industry, business, and so on—and also the heights of buildings in question.

With the topographical and aerial surveys made, the next step is to elaborate the zoning survey so as to record accurate and detailed information on the existing occupancy and use of land. These are just the preliminary surveys for the continuous alteration job. For that is what planning for the future development of a city amounts to—an alteration job, complicated by a rigorous sense of the organism, as a whole, at all its foreseeable future stages.

7. *Zoning*

Zoning is an unfortunate word derived from the theoretic diagram of a city on a plain growing in all directions, and spreading its organic elements in concentric rings which successively take the place of one another. Cities do not grow that way. The fact that westerly winds prevail in those latitudes where most large cities occur is in itself sufficient to upset the symmetry of such a development. The location of rivers, harbours, railways, traffic routes, obstructions such as hills and existing neighbouring communities have far more effect than prevailing winds in upsetting the applicability of this regular figure. However, the word is there and one may as well use it, understanding that a zone is far more likely to take the form of a wedge than of a belt. Obviously the organic parts of a city cannot go on growing in the future without in large measure occupying land now dedicated to other organic parts. In producing an orderly scheme of development which takes account of the probable life of construction of various kinds, the town planner must rely on that rare gift, scientific imagination.

Then things will happen to upset all calculations. Elasticity to meet unforeseen developments is a quality of high importance in any scheme. The planners of the New Town, to the north of the Edinburgh of Jacobite times, were nonplussed by the invention of the railway. The planners of urban development in the nineteenth century could not foresee the advent of the automobile. But with these lessons before them the planners of recent times have not been slow to make provision for aerial transport.

The constricted site of the City of New York forced building up into the air, and that city is full of madly uneconomic skyscrapers, embarked upon for competitive advertising purposes. But incidentally the true economic value of fairly tall buildings for certain classes of business has been proved. These, averaging eighteen stories, are practical, economic, convenient, sane, and actually reduce street traffic, except at peak hours, in spite of all that has been said to the contrary. This again was something which town planners of half a century ago could not foresee, but which they began to realize and take account of as soon as it was manifest. The advent of the economic tall building means that there is an organic element or zone in a city, which may grow very rapidly as to accommodation, while growing quite slowly as to land area.

At the root of much good zoning practice is the law of value support by homogeneous development. Even rival departmental stores gain support from close proximity. Houses of a kind, shops of a kind, business buildings of a kind, even factories of a kind, support one another in value by proximity. This is of the nature of things and has always been so; the reasons in each case are different but obvious, and the point need not be laboured. It is to advantage to group theatres in a district, and banks in a district; such districts being located in virtue of relations with other districts. This is what makes town planning a possible field for the designer. The districts of a town are like the rooms of a house, their traffic connexions are like the doors and passages. Only, the districts tend to grow and to displace one another. Without zoning control they will not do this to advantage and can only be expected to interpenetrate with destructive effect. That is to say, buildings behave like the flowers in an ill-kept rock garden, where the dwarf iris, crocus, veronica, thyme, and silene all intermingle; they all suffer, but the one of least account, the last mentioned, takes eventual possession.

Zoning control is exercised by dividing the urban area into districts, each dedicated to a limited purpose—residential districts of three or more classes (of which one may be the hotel district), retail, wholesale, and general shopping districts, commercial and financial business districts, heavy and light industrial districts, theatre land, and *cité universitaire*. All this is in principle like the setting out of the districts of a house in rooms, or the setting out of the districts of a university in departmental buildings, but in selecting the confines of districts in a city, their future overlaps and displacements and extensions must be taken into account. Conservation, through the prevention of interpenetration and overlap until the time is ripe, is the root idea. Once the districts are allotted, by-laws as to the occupancy of land and the heights of buildings are promulgated to encourage the kind of building appropriate to the best use of the district. Until a zone or district is fairly closely occupied and built up with the class of buildings to which it is best suited, it is inadvisable to extend it; but long years before such extension is permitted it should be foreseen. It is in the interest of every property owner in the whole community that this should be done, and that it should be a matter of public knowledge. Otherwise there is no limit to exploitation of inside information, town planning by surprise, and lack of continuity in development.

A city may have twenty or thirty zones to which six or eight separate by-laws governing density and occupancy are made applicable—one district under one by-law, several districts under another, perhaps. All this is just as clearly design as if the whole thing were done with a pencil on a drawing-board instead of by resolution in a committee room.

8. *Traffic*

And now what about traffic planning? The traffic possibilities will largely determine the zoning and vice versa. As traffic specialists are human beings, they are very apt to magnify their office and suffer from the delusion that their part of the work dominates the whole situation.

Just as the theoretic zone diagram of a city leads to a figure comprising concentric circles, so the theoretic traffic plan resolves itself into a spider's web of radial and circular routes, with a detail filling in of the compartments. This figure is, in practice, of quite limited application. Bits of such a figure or pattern can be very suitably applied in the districts towards the outside of a city, but to encourage cross-city traffic to pass through the centre in all directions leads to congestion of the worst kind. Thus a spider's web plan, if it persists to the centre, must be alleviated with by-pass routes. It may be possible to conceive, but it is not possible to find a city with a main arterial problem susceptible of a rational and at the same time a symmetrical solution. Parts of the problem may be symmetrical in their nature and therefore soluble by a symmetrical figure, but such are usually of very limited extent from the very nature of things.

In dealing with traffic it is always necessary to consider what proportion within a given length is through traffic, and what proportion is locally generated. Through traffic demands grade separation for its fullest efficiency, while locally generated traffic demands collection and dissemination by means of branch and cross routes. The zone served by the traffic may have very varied requirements. A heavy industries zone may be largely dependent on arterial traffic routes passing through it, while a residential section may be dependent for its continuance on the exclusion of through traffic.

The gridiron street plan when properly oriented is in many cases the most convenient pattern to adopt for filling in the detailed street plan in an area enclosed by main traffic routes, but all the dignity of the august precedent of ancient Alexandria cannot redeem the grid plan from irrationality, when applied to the arterial plan of a city. Cities which have been allowed to grow inorganically by the continuous spread of a gridiron plan, as so many cities in North America have been allowed to do, are sooner or later faced with the vast expense of replanning for radial or diagonal systems through the gridiron. Rossi's plan of St. Petersburg is a good example of gridiron planning properly applied within the radials and semicircular routes of a half-spider's web general plan. The grid fillings in different parts of that city vary.

The many great advantages of a hexagonal pattern for the major streets have been explored and demonstrated by the late Noulan Cauchon. It is not easy, however, to make out a case for hexagonal planning in the minor street fillings between. That procedure must inevitably involve the solution of building planning problems on a hexagonal, instead of a rectangular, basis. It may be possible to solve the problem of the small house with a saving of area and an increment of convenience on a hexagonal basis, but allowing, for the sake of argument, that it is so, it must be admitted that such advantages would be more than offset by constructional difficulties and cost. 'Fair work and square work' will long remain the dominant basis for pattern in building. The amelioration of a gridiron plan by means of a superimposed hexagonal arterial system (instead of 45° diagonals or radials at various angles) is eminently feasible, and the many advantages of such a solution can be enhanced by not insisting too rigidly on the regularity of the hexagonal figures thus developed.

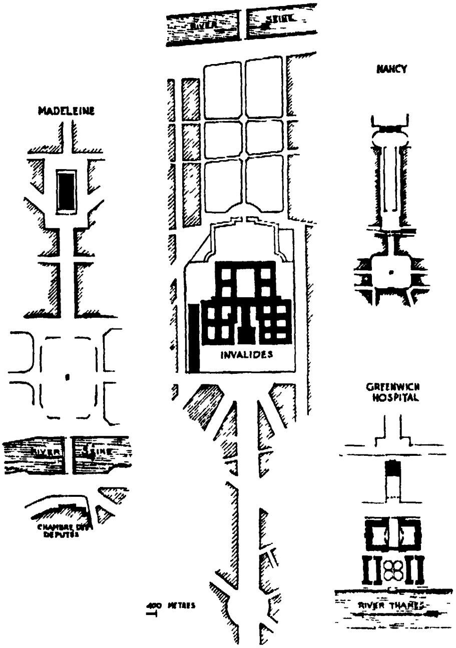


Fig. 133. Some notable plans in the grand manner.

9. *Axiation*

Axiation applied to limited elements of the general plan, as distinct from a symmetrical solution imposed upon the plan as a whole, is always in order when there are dual elements to deal with, or elaborate groupings of related buildings to be taken account of. This is pre-eminently the technique of the grand manner. The nuclear element in the St. Petersburg plan and the several nuclear elements of the Paris plan are cases in point. It is difficult to leave these citations without succumbing to the temptation to describe their superlative splendours. More will be said of this principle in a later chapter. Properly speaking, these are examples of composition in group planning rather than of town planning. But it is a function of town planning (from the architect's point of view its main function) to provide suitable sites for buildings and for groups of buildings. The conceptions of the closed vista, the whole block dedicated to one building, the whole street planned and composed as a unit, and the heterogeneous group planned as one thing are the contributions of those who deal with planning on the grander scale in connexion with the development of cities and towns. But exponents of the grand manner sometimes make themselves supremely ridiculous and provoke economic burdens when they push formality too far, resorting to its methods for their own sake, without reference to opportunity and occasion. On the other hand, when opportunities for grand planning are lost, as is often the case through lack of foresight and imagination, the whole world is the poorer.

10. *Summary*

Such are the main principles of town planning which differs from other planning in the scale of the things dealt with, the time it will take to achieve tangible and visible results, and the need to reckon with growth and change. A town plan is never done until the sands of the desert, or the trees of the forest, or the lava flows from a volcano have hidden the walls of its houses and the courses of its streets. These principles have been discussed under two main headings, zoning and traffic, and now, in conclusion, the importance of not keeping the two things apart in our minds may be emphasized. Action describable under either heading is always profoundly affected by possibilities under the other. A room is useless without a door and a door is useless without a room.

One might pursue this progressive review of design into the larger fields of regional planning and the planning of the physical elements of national life, but there is no need. That ungrateful task may be relinquished the more readily as, the farther one goes in that direction, the more does form tend to become vague and intangible and divorced from actual visual image. Whether purpose, material, and technique remain the determinants of things throughout the cosmos, as they are of forms throughout the visible apparatus of life, it is not here necessary to inquire. It is difficult to suppose it to be otherwise.

The remaining chapters are devoted largely to artistry—the modifications of form which reveal how the designer feels about his solution of the problem set him.

Part IV

DESIGN AND ARTISTRY

XXII

STRUCTURAL AND ECONOMIC ANALYSIS

1. *Analysis of Design*

THERE are certain matters of a severely practical kind which lie at the very roots of all architectural effort, yet have little or no artistic implications. These have to be taken into consideration, and dealt with to some degree, in the design of every building, small or great, as soon as form has been broadly established, but before its more detailed elaboration can be proceeded with. It is therefore appropriate to discuss them following what has been said as to assembling elements of accommodation.

The structural analysis of a solution expressive of purpose and use may be taken first. In the case of large buildings the need of this is fairly obvious; no building, however small and simple, can be contrived without resort to such analysis.

2. *Spatial Planning*

Throughout the process of planning a building there is usually a general knowledge of the materials to be employed, and often something in the way of broad assumptions as to the method of their employment. That is to say, when walls, partitions, floors, and roofs are laid out by lines on paper indicating their relative positions and dimensions, the designer as he sets them out may, and often does, imagine these structural elements as made of something in a particular way. But this is not necessarily so; and a plan may be composed purely in terms of space and use. A designer, working to an accustomed scale upon a problem of a kind familiar to him, often forgets, for the time being, that there are such things as bricks and mortar and building operations, knowing well that a time will come when he must visualize these things very clearly in the preparation of working drawings and specifications. When he thus concentrates on spatial relations he may even, for that time being, cease to visualize actual dimensions, seeking the solution of his problem of arrangement in the geometrical expressions on the paper before him. When he acts thus, he is just doing what the mathematician does when, having stated his problem in the form of an equation, every term in which has a concrete meaning, he works out the equation without any thought to these meanings, but with a knowledge that the resultant mathematical expression will have a concrete meaning.

Whether the designer has formed material and structural images of everything he has had occasion to indicate on the paper before him, as he proceeded, or has put certain symbols of things into the machine of mind, eye, hand, paper, and pencil, turned on the power, and produced a resultant symbol concretely imaginable, there always comes a time, if the matter in hand is ever to come into being as a complete design, or in execution, when structure must be investigated.

3. *Material Support*

The first step in this investigation, when dealing with a building, is the location of points and lines of support. This means an arrangement of dots on the paper—what the French call the *poché* of the plan. The plan, shown in lines, gives the spatial composition; the plan, shown in dots, reveals the structural composition. In the case where the exterior enveloping walls and the interior enclosing walls are all bearing walls (as in the more primitive types of construction), lines appropriately thickened reveal the structural system; and dots are not involved. But, even in such cases, the openings that occur in walls usually cut the wall up into a series of dashes, whose centres are dots. So, with the understanding that the dots may be elongated into dashes, or even into lines, one may speak of the reduction of the plan to points of support, indicated on the drawing by dots. These give a graphic expression of the structural system which supports floors and roof covering. Actual enclosure by partitions and curtain walls thus becomes a separate issue. The points of support relate directly to structure; the partitions and curtain walls relate directly to enclosure; but the structure and the enclosure are themselves interrelated, the problem of enclosure determining the problem of structure, in the first instance, and the problem of structure in turn determining the character of the enclosing members.

4. *Points of Support and Framing*

When curtain walls and piers associated with them are of the same material—as was the case in many Roman, Medieval, and Renaissance buildings—one may regard the piers simply as thicken-ings of the curtain wall at intervals; but structurally they are separate members. With the advent of cast iron, steel, and, more recently, concrete and reinforced concrete columns, there has come about a material differentiation between these members and the curtain walls of brick or stone. Piers of such materials, of high compressive strength, can be made much smaller than piers of equal resistance in brick or stone, and may thus often be entirely enclosed within a wall only thick enough to serve as a curtain wall. Where this cannot be done, they may protrude on one side only of such walls; and if there is a question of fireproofing or of encasement for protection against corrosion, or of covering, in the interest of general neatness, they may not even show at all on the other side.

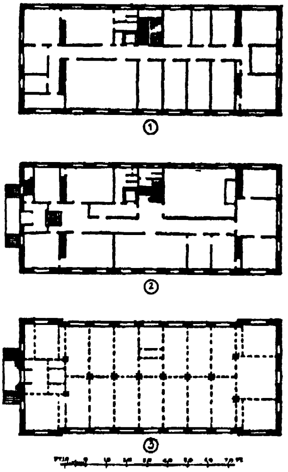


FIG. 134. 1, 2. Upper and main floors of Pulp and Paper Institute, Montreal—space distribution. 3. Main floor plan —distribution of points of support and framing.

The structural development, which began with piers of superior resistance, in due course extended to the framing for floors and roofs. And now, for a generation, large structures have usually had a more or less invisible skeleton, or framework, to carry floors, roofs, and enveloping walls as well. This has made it possible to economize greatly on wall thicknesses, saving both material and internal space. It has affected planning in two ways: by giving the layout of points of support a greater importance on the one hand; and on the other, by giving greater elasticity in the relations of one floor plan to that below it, through easy contrivance of invisible support by means of small members of great strength. The new construction has also had a most marked effect in the matter of large openings spanned by beams, where, in an earlier type of construction, resort would have been had to arches and the abutments they demand.

The traditions of the old architectures of direct construction have clung to the new indirect structural method. The frequent need of a protective covering to the skeleton, combined with the slenderness of this skeleton, which facilitates its concealment, have led to an architecture based largely on make-believe and ingenious deception. Signs are not wanting that, under the compulsion of economic stress, experiment in an architecture of reality is now taking place in many quarters. Admitting that the achievement of such an architecture is a commendable aim, it may be suggested that it is by an evolutionary process, rather than by revolution, that this can be brought about. Originality in the search for form must not be confused with that frivolity in exploiting new means, of which there is much evidence.

5. *The Structural Bay*

When establishing the dimensions of the structural bay for an element involving continuity of repetition within itself, there are two sets of considerations to be taken into account; both are in essence economic. Structural considerations and functional considerations must be brought into harmony; and this may require some compromise. Every structural system has its economic limitations. The economic spans for beams and panels vary for various materials and systems. The use units for an office building, or a school building, may be structurally soluble in one bay, in two bays, or in a number of bays. For each structural bay one, two, or more openings may be assigned. To take a very simple case: for an office building in a certain city district, for a certain type of occupancy, on which its commercial success must depend, units of 16 ft. 6 in. × 22 ft. may be ideal from the point of view of functional economy. Bays either of 14 ft. × 24 ft. or 17 ft. × 20 ft. may both be ideal from the point of view of structural economy, depending on the materials and system used. Compromise with one or other structural system may be in order. Or again, in a common-school, classroom units 30 ft. × 25 ft. may be ideal, and the question must arise as to whether these units are to correspond with structural bays 30 ft. × 25 ft., or 15 ft. × 25 ft., or 10 ft. × 25 ft., or 7 ft. 6 in. × 25 ft. If there must be four windows in the 30-ft. walls of the classrooms, the 10 ft. × 25 ft. bay may be ruled out. The 15 ft. × 25 ft. will admit of two pairs of windows; the other sizes of bay will admit of four, continuously spaced. Choice of a system, at once appropriate and economically advantageous, will thus determine the points of support. There may be an economy in construction by reducing the width or depth of the use unit by a foot; this economy may be advantageous out of all proportion to the actual cubic contents by which the building as a whole, or the solid parts of the building, are thus reduced. But it may be detrimental to use.

These structural economic questions have niceties on which the profit, or loss, of a costly investment may turn. The relative costs in any given year of cement, sand, aggregate, steel, and labour, and the relative amount of labour involved in any particular system of construction making use of such materials, may be decisive.

It is on such matters and the compromises which they enjoin as between function and structure—that is to say, on synthesis of purpose, material, and technique—that the placing of points of support usually depends. Once the bay is established the basis for any rhythmic arrangement of parts, which the designer may have occasion to exploit, is determined. Architecture has its basis in grim prosaic realities. If there is often much room for choice between alternatives, there is but little room for freedom of action; and still less for whimsical inspiration out of the blue. The basis is in pure form, using the term in the sense defined in an early chapter.

6. *Efficiency Analysis*

The analysis of the design for a building with respect to efficiency is often necessary. In cases where alternative solutions are offered, such an analysis may be a valuable guide as to relative merits; or, where only one design is under consideration, resort to analysis may furnish a valuable basis of comparison with other buildings of a similar kind. It is the percentages of space effective for use, of space devoted to circulation, of space given to general overhead services (such as heating plant) and of space occupied by the solids of walls, floors, and roofs (including lost space) that are sought. Table I (p. 320) gives an analysis under these several headings for ten buildings, all devoted to educational purposes, and exemplifies comparison for efficiency

7. *Cost Analysis*

Another kind of analysis, taking account of cost, is sometimes useful. Table II (p. 320) institutes comparisons which relate size to cost. It covers certain school buildings, distinguishing between costs per cubic foot and costs per child accommodated, and incidentally provides a basis for comparison of numbers of cubic feet per child in the several buildings.

TABLE I

ANALYSIS OF TEN EDUCATIONAL BUILDINGS

Building	*Place*	*Total cont.* cu. ft.	*Effective cont.* cu. ft. %	*Passages, stairs, &c., cont.* cu. ft. %	*Engineering accom.* cu. ft. %	*Walls, floors, ducts* cu. ft. %
Strathearn School	Montreal	870,000	48·3	15·2	4·6	31·9
Bancroft School	Montreal	1,264,000	48·1	13·6	5·5	32·8
Peace Centennial School	Montreal	1,440,000	48·5	14·2	5·0	32·3
Arts Building, Univ. of Alberta	Edmonton	1,290,000	46·5	17·5	3·8	32·2
Medical Building, Univ. of Alberta	Edmonton	1,690,000	53·0	11·7	1·5	33·8
Engineering Building, McGill Univ.	Montreal	1,120,000	63·0	6·2	0·9	29·9
Pathology Building, McGill Univ.	Montreal	804,000	55·2	11·3	2·5	31·0
Laboratory (Single), Univ. of Alberta	Edmonton	195,000	78·5	6·1	..	15·4
Laboratory (Double), Univ. of Alberta	Edmonton	216,000	79·2	4·1	..	16·7
Workman Building, McGill Univ.	Montreal	650,000	66·9	5·7	1·5	25·9

N. & H.

TABLE II

COMPARATIVE TABLE OF COSTS

	Edward VII	*Strathearn*	*Peace Centennial*	*Bancroft*
Common classes	22	26	31	29
Kindergarten	2	2	2	2
Sloyd	0	0	1	1
Cookery	0	0	1	1
Total classrooms	24	28	35	33
Boys' playroom area, feet	3,300	2,700	6,500	5,000
Girls' playroom area, feet	1,900	2,400	4,000	5,000
Gymnasium area, feet	2,000	2,100	3,600	2,200
Cubic contents, feet	931,000	873,000	1,434,000	1,250,000
Total cost	$174,325	$201,500	$250,000	$222,000
Cost per cubic foot	19 cents	23 cents	17·5 cents	17·8 cents
Cost per classroom	$7,280	$7,150	$7,143	$6,700
Number of children	1,000	1,200	1,500	1,400
Cost per child	$174	$167	$167	$157

N. & H.

8. *Revenue Analysis*

In the case of designs for buildings intended to produce revenue, the analysis is usually called a 'set-up'. This shows the percentage of effective space and the rental value derivable therefrom. This rental value is then placed against the total cost, with a view to showing whether the investment will be productive. Such an analysis is just an abbreviated summary of one aspect of the solution offered for the problem. It may be further elaborated by adding data with respect to the financing of the undertaking, but this is hardly the designer's business. The questions of the cost and possible future value of the land are, however, his affair, for once the land is 'improved' by having a building erected on it, the land cost is merged in that of the building. Taxation, running expenses, and cost of maintenance are also matters on which the designer should be competent to give an opinion. These are part of the premisses from which his solution for the problem is a deduction. There follows a table showing the set-up for a scheme combining offices for a specific use, shops of a certain character and a garage of a certain type, all in one structure limited in size by building by-laws.

TABLE III

PROJECT FOR A COMMERCIAL BUILDING; ANALYSIS OF COST AND INCOME

Cubic Contents

	Office and Stores	*Garage and Factory*
Below 2nd Floor	882,000	306,000
Above 2nd Floor	2,280,000	1,560,000
	Cu. ft. 3,162,000	1,866,000

Building Costs

Offices and Stores	3,162,000 cu. ft. at 48 c. =	$1,520,000.00
Garage and Factory	1,866,000 cu. ft. ,, 18 c. =	336,000.00
		$1,856,000.00
Say with extras	$1,660,000.00 + $340,000.00 =	$2,000,000.00
Land	1,100,000.00 + 300,000.00 =	1,400,000.00
	Totals $2,760,000.00 + $640,000.00 =	$3,400,000.00

TABLE III (*cont.*)

Revenue

	Sq. ft.	
Offices	13,735 × 9 floors = 124,000 sq. ft. at $2.25 =	$279,000.00
Stores	4,070 at $6.00 = $24,420.00	
	4,700 ,, 3.00 = 14,100.00	
	17,100 ,, 4.00 = 68,400.00	
	$106,920.00	106,920.00
		$385,920.00
	Less Vacancies: say 9·3%	35,920.00
		$350,000.00
	Less Operating: say 3/7ths of Rent Income	150,000.00
	Net	$200,000.00
Garage and Factory:		
	500 cars at $180.00 per an.	$90,000.00
	Factory, 14,100 sq. ft. at 60 c.	8,500.00
		$98,500.00
	Less vacancies: say 15%	13,500.00
		$85,000.00
	Add Miscellaneous Sales, &c.	10,000.00
		$95,000.00
	Garage Operating Expenses	56,500.00
	Net	$38,500.00

Return on Equity

Stores and Offices (Building and Land)		$2,760,000.00
Mortgage, 60%		1,660,000.00
	Equity	$1,100,000.00
Revenue, net	$200,000.00	
Less 5% on Mortgage	83,000.00	
Return	$117,000.00 = 10·6% on Equity	
Garage and Factory (Building and Land)		$640,000.00
Mortgage, 60%		360,000.00
	Equity	$280,000.00
Revenue, net	$38,500.00	
Less 5% on Mortgage	18,000.00	
Return	$20,500.00 = 7·3% on Equity	
Combined Income:		
Stores and Offices		$117,000.00
Garage and Factory		20,500.00
		$137,500.00

Total Return: 9·9% on $1,380,000.00 Equity

N. & H. 1927.

After the above remarks on the structural and economic analysis of designs for buildings, we may proceed to deal with composition. This will be found to be no abstract science of spatial division and arrangement, but a further step towards the elaboration of form, with roots in the solid ground of practicality, even when its branches sway to the upper airs breathed from Olympian heights.

XXIII

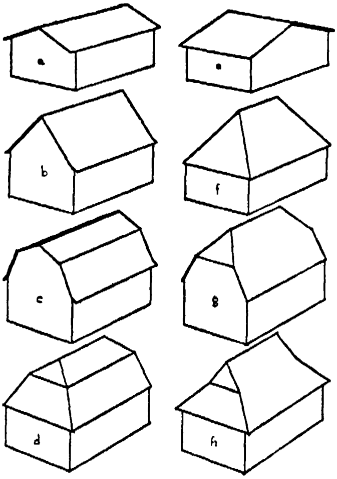
ARCHITECTURAL COMPOSITION

1. *Enveloping Form*

ONCE the sizes, number, and arrangement of the rooms to be contained in a building and the structural system to be employed are determined, the form and dimensions of the enclosing envelope are implied. What the French call the *parti* has then been found. But the envelope usually has functions peculiar to itself, over and above that part of its purpose which is mere enclosure. These include its own stability, resistance to the weather, and economic efficiency. The design of the exterior of a building is, therefore, something more than a mere agglomeration of enclosing walls and roofs to such rooms within as happen to fall on the outside of the whole mass of accommodation. It not infrequently happens that the envelope of a complex organism, such as an animal or a building, is symmetrical for functional reasons of its own, while the internal organs are not. Thus the envelope of a building may take the form of a simple rectangular block with regularly spaced openings. It may, on the other hand, in deference to its contents, accept articulations from each and every organic element within.

Between these two extreme cases there are, of course, infinite possible gradations of compromise as to what derives from the contents and what may derive from the nature of the envelope, when discovering the form of the latter. There is here no question of a better or worse principle for guidance, independent of the case in point. The Palazzo Farnese in Rome, and Compton Wynyates in Warwickshire, may be cited as fairly extreme cases, and any Georgian mansion consisting of a main block and wings as an intermediate compromise. For any given case, that degree of compromise, between the enveloping form that would tell most about itself and least of what is behind it, and the enveloping form that would do the reverse, is best which, with due regard to internal amenities, is most economic. Best, that is, from the point of view of pure design; but evolution and tradition and artistry may introduce considerations to lead decision from a best of this kind. Purity may be sacrificed for other virtues.

The elementary house form is a rectangular parallelepiped in hot dry climates; and with a pitched roof set over it where rain is frequent. This structural enclosing envelope may be enlarged in two ways: by making it bigger (in one, two, or all three directions); or by adding other elements more or less like the first. The one method leads to the all-embracing block; the other to the spreading group. The block tends to preserve its symmetrical integrity. The group may be symmetrical, or irregular, or an irregular arrangement of symmetrical elements.



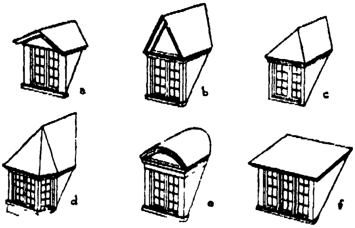


FIG. 136.

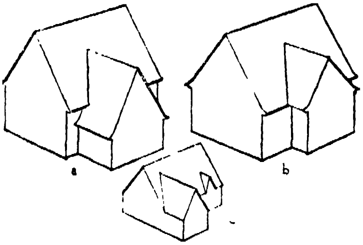


FIG. 135.

FIG. 137.

FIG. 135. Enveloping house forms.

FIG. 136. Dormer windows with pitched roofs.

FIG. 137.

a. A main block with subordinate gable stopped against it.

b. As before, but snow would not clear from the valley as well as in *a*.

c. A defective expression in form which is common. The subordinate and the main statements run into each other without due punctuation.

An example of conflict between the internal organs and the envelope in the evolution of ship-building is of interest. The hulls of Queen Elizabeth's ships which carried guns had low waists and much sheer, with additional decks added fore and aft. They had no horizontal lines; the stringers, carlins, and strakes, which kept the ribs together and connected them to the deck beams, followed the sheer which the envelope demanded. The guns thus stood on curved decks at varied angles. About the time of Mr. Pepys, the number of guns carried having increased, they were placed on a horizontal cambered gun deck, to facilitate accuracy when letting off a broadside, at a given moment, as the ships rolled. The stringers, carlins, and strakes for the structure of the hull retained their sheer, but were now partly dissociated from the level internal deck lines. Thus the level row of gun ports in these ships occurs out of reference to the strakes and stringers. This incongruity of form was usually partly masked by means of decorative wreaths around the gun ports. With the increase of guns and gun decks, the sheer of the hull was abandoned later on. So Nelson's ships were built high and horizontally decked throughout. Then, inheriting the horizontal deck tradition, the merchant ships of mid-Victorian times were built without sheer, but low. These were wet, unhandy craft to work on. This bad type gave way before the ships of the Canadian Maritime Provinces and New England, with their pronounced sheer, which were safe and comfortable. This latter part of the story is irrelevant to the point at issue, though interesting as showing the law of survival at work in the evolution of structural design. It is the conflict of internal and external form revealed in the placing of gun ports and strakes in King Charles's ships that illustrates so clearly what is meant by congruity and consistency between the inside and the outside of a structure.

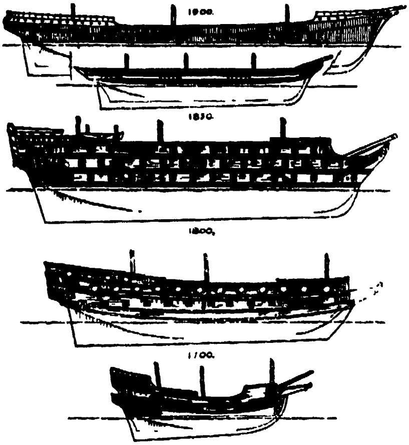


FIG. 138. Gundecks and sheer, in harmony and in conflict.

The case of a certain hospital in Scotland may here be cited. It had a high gable with a large window in one of the wings. The gable contained a great sewing-room, and the window had its sill about seven feet above the floor. That sill had to be lowered to table height so that the sewing women might see out and so keep cheery. The placing of that window in the first instance was determined by the designer's insistence on certain quasi-structural features, of frequent occurrence in an architecture which flourished a thousand miles to the southward three hundred years before that gable was built. After the lower lights had been cut down, these features became incongruous and lost significance; the window got 'out of proportion' and 'out of scale' in that its new characteristics of form were rather surprising with respect to the character of the other windows, and what might be called the architectural expectation. People said the gable had been spoiled and was now ugly, the architect leading the chorus; when they got accustomed to the 'eye-sore' it ceased to 'hurt'. The matron then had some more windows altered for the happiness of the inmates. Such cases of failure to relate exterior structure to internal arrangement and use are not uncommon. They are due to inadequate exploration of function, and occur most frequently through the persistence of an accustomed form, without reference to a new fact—a putting of new wine into old bottles.

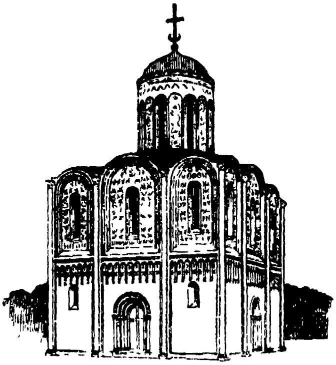


FIG. 139. Cathedral of Dimitri, Vladimir, 1194. (*Russische Baukunst*, Muller.)

Note: Figs. 107, 114, 139, 140 illustrate ancient Russian churches, each full of individual character.

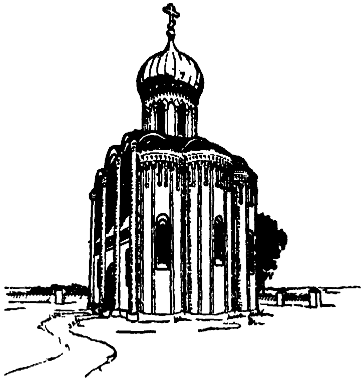


FIG. 140. Church of St. Mary, Vladimir, *c.* 1165. (*Russische Baukunst*, Müller.)

2. *Unity*

The enveloping form may be so simple that its characteristic unity is never in doubt. Giotto's Tower and the Baptistry of S. Giovanni at Florence, the Parthenon, any hipped, or gabled, or flat-topped house with a rectangular general plan, are cases in point. Again the enveloping form may be as richly complex as that of a Medieval Russian Church and owe its unity to an all-pervading consistency of unique elaboration. When the enveloping form is based upon a highly articulated straggling plan, characteristic unity can be dependent on general similarity and analogy of form in the several parts, out of which the whole is made up. If there is no such general similarity, some part may be selected for special emphasis about which the other parts can be grouped in subordination. When there is no such singular element to exploit and no general similarity among the elements, each element remains a separate unit to be developed as such. In that case some axial arrangement involving balanced groups may yet be discoverable without unduly outraging the facts of the case.

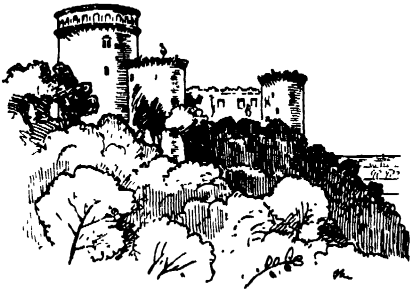


FIG. 141. Coucy in 1908.

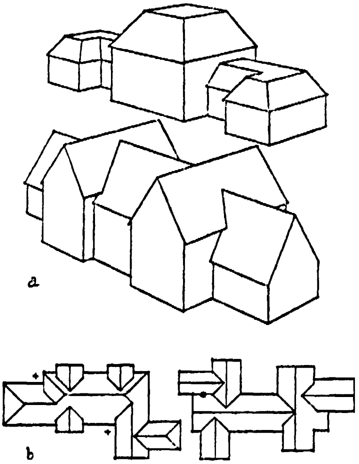


FIG. 142. Composition involving dominant roof elements. In the roof plans + + mark good snow clearing forms. The * marks a form that cannot be used in a snowy climate.

Most structural problems find expression neither in a simple unit, nor in a heterogeneous collection of units; but in a form made up of a dominant mass with subordinate elements, the dominance being strong or weak as the case may be. Dominance is usually due to size; but often to character—sometimes to both. Thus, a country house may consist of a main block with wings of equal or unequal importance, symmetrically or unsymmetrically disposed. The main block then holds the whole together as a complex unit. It is then open to the designer to maintain a due distinction between the dominant and the various subordinate elements. He may exaggerate the contrast between the dominant and subordinate elements, or he may harmonize and reduce their characteristic differences, at will. That must depend on whether he feels the differences or the similarities as most characteristic of the thing as a whole. His predilection, or personal style, may be based on the technique of contrast, or on the technique of harmony; and he may have more ambition to exploit his way of solving problems than to explore his problems for their suggestions.

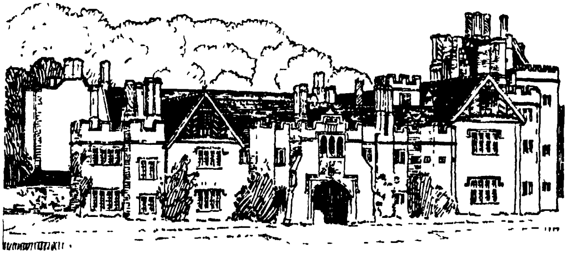


FIG. 143. Compton Wynyates, War., England, *c.* 1520.

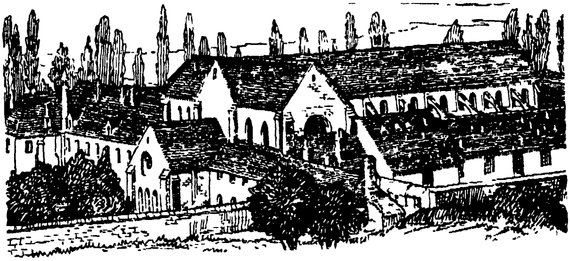


FIG. 144. Abbey at Noirac, Cher, France, thirteenth century and seventeenth century.

Thus some seek inspiration in their theme—the engineering solution of the problem, which then becomes the raw material of composition; others, less sympathetic to their themes, force their contrasts, or their harmonies, in obedience to their instinct for either basis of characterization. The greatest architects, like the greatest writers, modify their style to their theme. Both contrast and harmony are inevitably present in any complex form; where either dominates the other, it is usually attributable to the artist's style. It is rarely indeed, however, that the nature of the problem does not carry with it some implication as to precedence. After all, artistry in design is based on what the artist feels about his problem. The problem and the artist's feeling are both involved. Some artists feel much the same way about all their problems; some feel differently about every one.

Sir Christopher Wren's was an architecture of harmony. He was never abrupt in his transitions. One thing grows out of another to constitute a coherent whole, whether in plan, in internal, or in external composition. During the later Gothic period, on the other hand, one often finds a primary dependence on striking contrasts of form—the horizontal set against the vertical; the big set against the little; the high against the low—as at 'Boston Stump'. In English architecture of the end of the last and the beginning of the present century, contrast is often predominant. The work of Sir Robert Lorimer and Mr. John Belcher, though differing greatly in temper, was of a kind to this extent, that no opportunity of exploiting a broad basis of contrast is missed. That does not mean that all sorts of forms are put in apposition to one another to the sacrifice of unity, but that the unity in any given case is mainly dependent on two sets of forms, each serving as a foil to enhance the characteristics of the other. Ludwig Hoffman, on the other hand, showed a versatile genius, sometimes forcing contrast to the limit, sometimes controlling every element in a disciplined harmony, as the occasion might suggest. Norman Shaw usually harmonized all the elements of his main composition, and then suddenly introduced some minor element contrasting sharply with the suavity of the major treatment.

3. *Voids and Solids*

Now the stuff the architectural composer has to deal with consists of very commonplace matters—walls, arcades, colonnades, windows, doorways, roofs, parapets, chimneys, and so on, which are all things complete in themselves; also piers, columns, lintels, arches, string-courses, cornices, and the like, which are the structural elements out of which such things are made up.

The arrangement of windows in walls, the commonest of all the exercises that claim an architect's ingenuity, may here be investigated; and first in the very ordinary case of a row of similar openings at equal distances centre to centre. If the number is equal, there is no question of a central emphasis; one then has the simple continuity of repetition, from end to end, the solids between the voids being similar. What of the end solids, where the wall returns at the quoins? The elevation consists of a series of equal bays, with windows, centrally placed, in each bay, whether partitions occur opposite the centres of the solids or not. The insides of the returning walls at the ends may then be expected to correspond more or less to the pier centres. How thick is the end wall and how wide are the intermediate piers? The face of the end solid is made up of a half intermediate solid, plus the thickness of the end wall. Is the width of this face greater or less than the width of an intermediate solid? If it is less, the end solids will be weaker, and look weaker, than the intermediate solids. There is what may be called a general expectation that they should be, and look, as strong, or stronger.

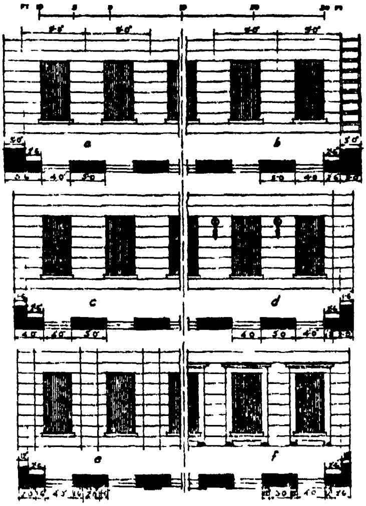


FIG. 145. Composition of voids and solids.

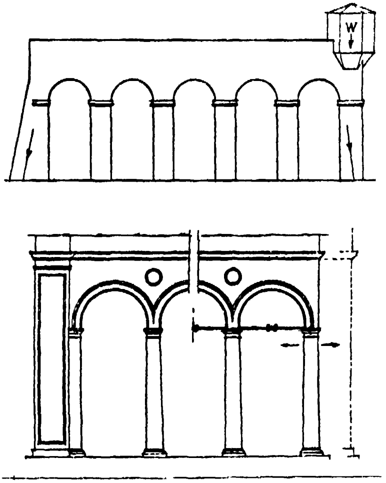


FIG. 146. The strong end solid required in arcades, otherwise a tie is needed.

For suppose the openings are arched; then the thrust of each arch counterbalances the thrust of that adjoining it; but, when one gets to the end of the series, mass must be relied on to keep the thrust directed within the fabric. For this one requires either an extension of the wall, so that it may contain the thrust, or a top weight, or both. Additional top weight on a narrower end pier will at once produce uneven stressing in the fabric, the larger intermediate piers or solids being less loaded than the smaller end ones.

Now, to return to the case of the row of windows, two courses are open. One may differentiate the narrow end solid to make it be and look stronger, as by building it in superior material, or one may make it as wide or even wider than the intermediate piers. This latter course presents no difficulty if the end wall is thick or contains an abundance of chimney flues. An end solid that looks weak, but is actually strong enough, is objectionable just because from time immemorial stronger end solids have been necessary. Surviving structures thus predominate in which a strong quoin is in evidence, and create the expectation.

The differentiation of the end solid or quoin, when it is narrower than the intermediates, is always possible; but there is a third way out, and that is to emphasize each solid throughout with a central column, pilaster, or pier, repeated at the ends by way of a quoin, and so dimensioned that the intermediate solids consist of one pier plus two pieces of curtain wall, while the end solid consists of one pier and one piece of curtain wall, all the pieces of curtain wall being equal. The horizontal division of the total wall, in the case of four openings, then becomes:

$$\text{Width of wall} = \tfrac{1}{2}\ \text{pier} + 4\ \text{bays} + \tfrac{1}{2}\ \text{pier},$$

each bay being made up of an opening and two pieces of curtain wall and two half piers (one). Such a distribution of space exemplifies a basis for what is called architectural treatment.

Yet another way of disguising a difference between small end and wide intermediate solids may be mentioned. Instead of resorting to piers or pilasters at the bay centres, one may frame the openings. The architectural framing of an opening reads with the opening, not with the solid of which it is a part. Each intermediate solid then has its surface reduced by two framings, while the narrower end solid has its surface reduced by only one. The division in the case of four openings becomes:

$$\text{Width of wall} = \tfrac{1}{2}\ \text{surface} + 4\ \text{bays} + \tfrac{1}{2}\ \text{surface},$$

each bay being made up of an opening with two frames and two half surfaces (one).

When an unequal number of openings is involved, the question of dealing with the outer solids is as before, but the centre opening of the group raises new issues. If there are three openings, the central one is strongly felt in any case; with five or seven, less so. Beyond nine the sense of axial symmetry in the group is lost in continuity. In the case of a group of three, demarcation of the central opening is a gilding of the lily; but in the case of five or seven, if the group impression is intended, some specialization of the central opening may be advisable so that there be no doubt about it. The common and natural occurrence of a central doorway often leads directly to some emphasis of the central window over the doorway as further advertisement of the way into the building. Such accentuation of central openings, coupled with the fact that a central doorway is apt to be wider than the openings flanking it, often leads to the widening of the central bay throughout its height, giving a slight interruption or modification of the general rhythm of the repeating bays, without actually cutting the composition of the wall in two. But when central emphasis is carried so far as to cut in two, there is another case altogether. The strong centre does not emphasize the continuity of the repeating group in which it occurs; it forces attention to the responding groups on each side of it and emphasizes their symmetry. It does not say, 'we are seven', but announces, 'as it is on the right hand, so it is on the left'.

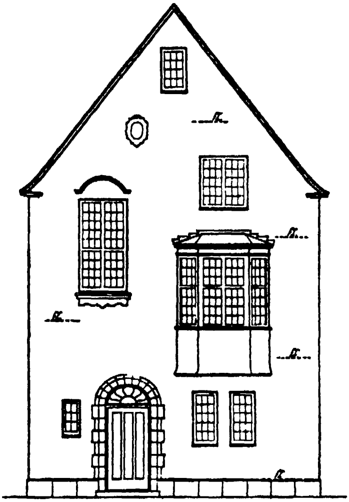


FIG. 147. Unsymmetrical composition dependent on balance of interest.

The less common problem of placing a number of openings unsymmetrically in a three- or four-story gable is of interest. The openings are, perhaps, quite heterogeneous in character; there may be a tall staircase window crossing a floor-level, a bay-window off centre of the gable, and so on; but, if there is a window at all near the apex, it will probably be on centre. The plan may absolutely fix the positions for some of the openings, but others may be subject to some shifting to right or left. After investigating the locations of the windows, the several types involved, and all available options, composition may proceed. Possibly there is the intention of securing balance and avoiding a lop-sided impression. If this is the desire, one may, as before, keep all windows well away from the quoins, and then regard them all together as an irregular group with a centre of attention of the group. This is something like seeking the centre of gravity of a set of objects whose weights the areas represent, or the centre of pressure of a sail plan. If this centre of interest does not fall on, or near, the central vertical line of the gable—in which case there is not much more to be said—one may by artifice contrive special emphasis for one or two of the windows on the side of the line where 'weight' is wanting. A very interesting bay-window or porch may thus be balanced by more area of plain window on the opposite side of the centre line; while a large area of blank wall on one side may be balanced by two smaller areas on the other side. One may, as a last resort, have recourse to placing a decorative panel or spot of interest at a point where it will restore balance. If somewhere one window occurs centrally over another, so much the better, but these two will form a rather emphatic sub-group, and may need compensatory balancing. Should a window occur over another, but just off centre, manœuvring of the plan may have to be resorted to so as to get them either exactly over one another, or well off each others' centres. So also, if a left jamb of one window falls in the same vertical line as a right jamb of another, the placing should be manœuvred to get the openings to stand clear of one another, or to overlap distinctly. In such cases, the greater the vertical distance between sills and the heads of openings below the better. These precepts are as much in the interest of good construction and the avoidance of sharp cross-strains in the wall, as for the mitigation of optical impressions of instability. The study of irregular medieval design and of the handling of asymmetrical problems in fenestration by that greatest of modern masters of such difficulties, Norman Shaw, is recommended in this connexion. The most irregular assemblage of elements can always be brought into balance, if balance is desired, and one knows how to achieve it.

If no balance of interest as between a major element, such as a wall and the minor elements of voids and solids comprised within it, be wanted, the maintenance of strong solids at the quoins and the avoidance of nearly centrally superimposed openings, and of right and left jambs in line with one another, may be all that is necessary. Sometimes it happens that regularly spaced groups of windows have to be superimposed, where the groups are diversified as to the number of windows in each. In that case it is obviously appropriate to centre one group over another, and to centre the outside openings of each group over one another, or at least to set their outer jambs in line over one another. Thus three windows may, as a group, be centred over a group of four windows. In such a case it may be in order to emphasize the central window of any group containing an odd number. The placing of windows, in cases where truly superimposed rows are out of the question, is akin to the distribution of 'charges' on an heraldic 'ordinary' and similar problems of the ornamentalist when seeking to fill his space evenly, but not symmetrically.

These general principles for regular and irregular fenestration have their applications in many other connexions that arise in composition. The nearly regular arrangement, the nearly symmetrical composition, is very apt to be confusing, just as a lame line in verse, a bad rhyme, or a disjointed phrase is confusing. Expectation is baulked; one ceases to have the meaning of what one is contemplating or reading helped into one's mind by a rhythm, when that rhythm breaks down. In place of apprehending there is surprised wonder

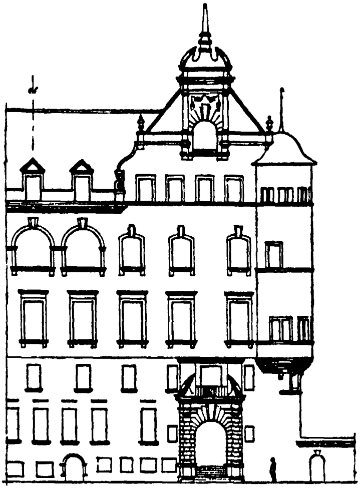


FIG. 148. New Scotland Yard, London (Norman Shaw). A masterly marshalling of irregular window groups.

Note: The great doorway is off centre as to the gable.

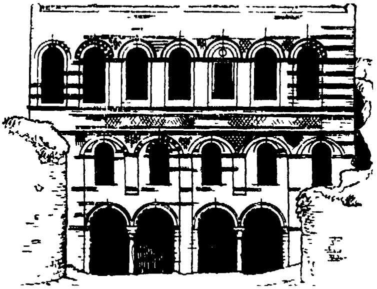


FIG. 149. Palace of Porphyrogenitus, Constantinople.

Note: The upper range of windows is not centred on those below. This is not noticeable because they form a continuous group while those below form two groups and there is a broad frieze between.

as to what is the matter. The engine has back-fired, so to speak—Pegasus has bucked.

4. *Axiation*

Leaving the problems of composition which arise in the case of an individual wall with openings, it is time to consider the greatest of all devices which the architectural composer possesses

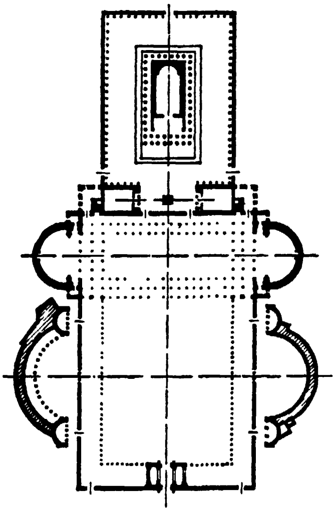


FIG. 150.

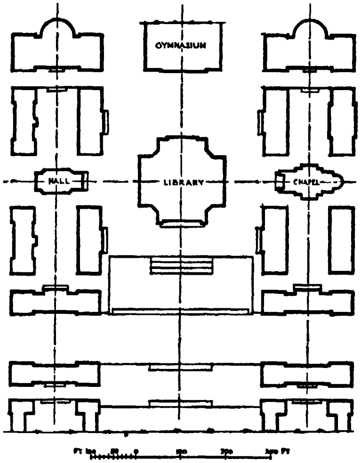


FIG. 151.

FIG. 150. Forum of Trajan, Rome. Two separate schemes, artificially related. If the column had to be included the centre of the Forum might be the place for it.

FIG. 151. The double axial tangle at Columbia University, N.Y.

for the orderly assemblage of the commonplace things with which he has occasion to deal—axiation. A scheme may be based on one axis of superlative importance with distinctly subordinate axes, the main axis leading to a focal point; or it may be based on several axes, differing in importance. In either case the axiation—provided it is appropriate to the nature of the problem—will make for clarity and ease of apprehension.

But it is fatal to the expression of organic relations of any kind to compose with two axes of equal or competing importance at right angles to one another and interest centred at the point of intersection. In that case conflict and confusion is assured. In the planning of the main group at Columbia University this was attempted with disastrous results. Reverse, inverse, and obverse forms then struggle for mastery, and without a gigantic compass suspended over the central library—itself a superb building redeemed from this confusion of orderliness, on one side at least, by the terrace and steps—one cannot readily tell what part of the great organism one is about to enter, or readily apprehend where the other parts lie. Compare this with the clear composition of the Virchow Hospital at Berlin, with one powerfully dominant axis leading from the gate house to the Mortuary Chapel—a simple little building of marked individuality, whose interior is unsurpassed by any other architectural achievement since the Middle Ages.

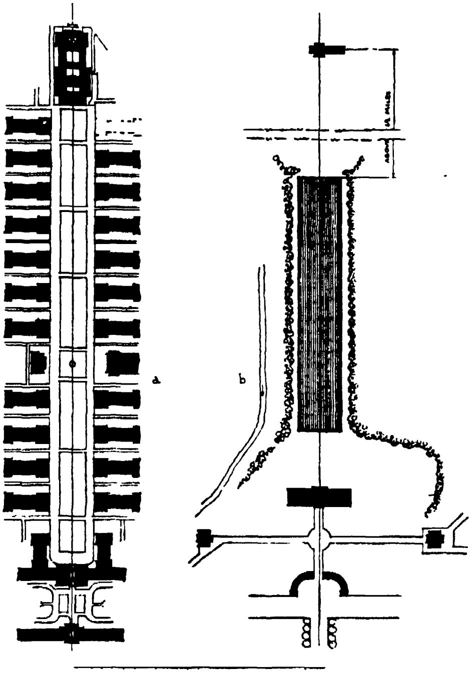


Fig. 152.
a. The Virchow Hospital, Berlin (Ludwig Hoffman).
b. A minor chateau with its grounds and waters (in Northern France).

The main axis as used by the Romans always entailed progression to a focal point. There may be something at each end of a main axis, but there is confusion if what is at one of the ends is not more important than what is at the other; otherwise a main axis becomes an altogether arbitrary basis for meaningless pattern.

As examples of axiation, properly employed on the grand scale, one may cite Wren's scheme for Greenwich Hospital, where he had the existing Queen's House and the Jones block to work in, and his no less masterly marshalling of humbler elements at Chelsea

Hospital.[1] The splendid axial scheme, terminated at the major end by the Madeleine, and at the minor end by the wholly false façade of the Chamber of Deputies, in Paris, may be regarded as made up of two schemes, face to face, with a bridge over the Seine between. The grounds and château at Ligny, in the north of France, furnish a modest example in the grand manner. This simplest and most charming of all French country houses, a long low building, is placed across the main axis which extends, on the one side, over a formal lake to a distant church on a hill, and on the other, to the gates of the park, flanked by stables of quadrant form—a superb composition of distant scenery, water, avenues, buildings, and outbuildings, all related in series by a formal arrangement.

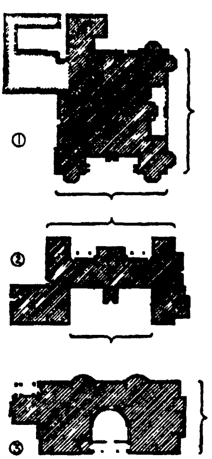


Fig. 153.

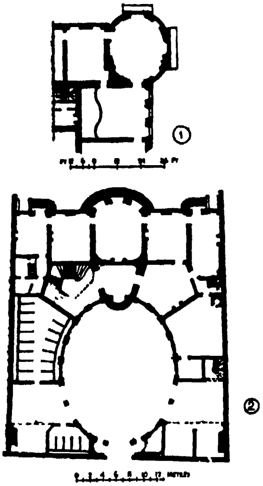


Fig. 154.

Fig. 153.

1. Overstrand Hall. 2. Daneshill. 3. Nashdown.

In these compositions, by Sir E. Lutyens, symmetry is resorted to only so far as it is natural to the solution.

Fig. 154.

1. Hôtel Soubise, Paris, eighteenth century.
2. Hôtel Amelot, Paris, eighteenth century.

Boffrand always discovered a form quite graceful and fully efficient.

Several of Sir Edwin Lutyens's country house plans consist of an irregular group composed of several related groups, each with a main exit of its own, but not all of equal importance. Boffrand's plans for the eighteenth-century *hôtels* of Paris are remarkable for the ingenuity of their axiation applied to internal planning, and for the consummate grace with which unpromising sites are made to dissolve into practical accommodation.

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[1] See Fig. 133 above.

5. *Unsymmetrical Composition*

There is no occasion to deal at great length here with the matter of asymmetrical composition, after what has been said in this connexion in an earlier chapter on planning. The irregular nature of a site, or the fundamental requirements of a problem, may militate against any attempt to put a naturally unsymmetrical subject into an axiated straight-jacket. When axiation is not, or cannot be, resorted to, or when it is only applicable to certain elements, as distinct from the thing as a whole, the designer can rely on other equally potent means of impression. He then deals with integrally whole things, rather than with things made up of two halves. What is lost in harmony may well be made up in contrast. Differences can be exploited in cases where resemblances cannot be established. It is a case of having something to say that can best or only be said in prose. The statement may be as exquisite as anything said in verse, but not versifiable.

Some of the irregular groups of associated structures which have not been designed by one master at one time, but, as in the cases of Edinburgh Castle and Mont St. Michel, have developed into what they are by an agglutinative process extended over several centuries, may nevertheless be regarded as examples of intentional composition. The difficulty of their sites and the variety of their elements have not been a hindrance, but a source of inspiration to the successive designers who have played their parts in masterpieces of joint effort. Such things cannot be explained away as mere accidental agglomerations of harmonious form and fortuitous contrasts. True, there is a natural quality about them, as in the case of any group of mixed trees and bushes growing on a rocky islet. But one may well bear in mind that under such conditions every tree and bush has a character of its own which is very largely the result of the growth of the trees and shrubs adjoining it. It is so with such groups of buildings—each element has a form profoundly modified by that of its neighbours. If this is not design, it must at least be admitted that it is good manners in building and, like all good manners, gives abundant scope for individuality besides facilitating corporate action directed to one end. The turret from which the Scottish Royal Standard is flown on occasion over Edinburgh Castle, and the soaring *flèche* above Mont St. Michel, are far from being accidents. Allowing for all prejudice in their favour due to archaeological respect, historical association, and to one's never having known them otherwise, what designer could suggest anything much different yet worthy to take the place of either? Far otherwise is it in the case of an accretion of recent date—the Curfew Tower—upon the outer walls of Windsor Castle, a monstrous form, born out of due season. One does well to remember, however, in these days of violent self-assertion, that there were times when, within the limits of a narrow spiritual experience, building was indeed the mistress art; times when the generality of men were artists enough to be aiders and abettors of a corporate artistic instinct that could do no wrong. How otherwise can one explain the infallibility of taste that is so astounding whenever the attention is turned to the work of men's hands done from the twelfth to the seventeenth centuries?

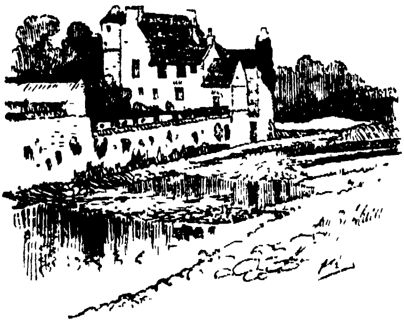

FIG. 155. Bothwells Castle, Haddington (now demolished). Unsymmetrical composition at its best.

Old Rodin has put it well:

> 'We moderns are but faint shadows of those who went before us, and should perish of thirst but for the springs which their spirit and faith have discovered for us.'

Among the arts of which the modern world has lost all but the distant glimmer, is the great art of asymmetrical composition in architecture. Perhaps we are wisest when we do not attempt it, but keep rigorously to our dividers and flatter ourselves with what the dividers bring into being.

XXIV

THE ELABORATION OF DETAIL

1. *The Minor Phrases of Form*

THE title of this chapter is not an avowal of delight on the part of the writer in elaborate design. Nothing is more futile in architecture than intricacy and complexity for their own sakes. The designer who has nothing to say is always right in being true to himself and saying nothing; but, when he has something to say of the kind that can only be said by the elaboration of detail in mouldings and by such-like modifications of structural elements, there are many things to be taken into account. The literary phrase-maker must know the current meanings and the derivations of the words he uses before he can use them effectively; he must know their spellings; a mere sequence of contrasting sounds following each other haphazard, even when rhythmically arranged, can convey nothing; they must embody image.

Once this is accepted the way is clear for the consideration of the things that have to be taken account of in the minor phrasing of design. As in all phrasing the meaning is incomplete without the context. It is in the highest degree illusory to profess enthusiasm over the section of a moulding as a line on paper, however subtle, however intricate; but one may well marvel and rejoice over a phrase, or passage of mouldings, in a given cornice or a given archivolt. A 'phrase' in the swordsman's sense of passage of arms is not very thrilling when reduced to the trace in space of a sword point, but in execution it may provoke a hurricane of applause. Raphael's cornice of the Pandolfini Palace in Florence, or the Cistercian arch of the entrance to the chapter house at Lincoln are cases in point. Paley's enormous collection of sections in his *Gothic Mouldings* is valueless, or worse, because it is offered without indications of scale, or position, or material. It has been argued in the preceding pages that there is no right or wrong, good or bad, beauty or ugliness in abstract form. At first sight the sections of mouldings may appear to be as abstract as any forms can well be, yet, on analysis, they yield the very practical secrets in virtue of which they are better or worse.

In dealing with functional ornamental forms the approach was through answers to the questions, 'What do these things say? What do they do?' Broadly speaking, they were found generally to be expressive of the work done by structural members, and occasionally expressive of the useful importance of certain parts, or elements, of the fabric in which they occur. On these aspects of the matter no more need here be said. For the designer of mouldings that are still to be wrought, there are other questions of another kind to be taken into account, questions on which their effectiveness as phrases also depends. Where do they go? In what material do they subsist? How are they to be made? Sense of scale and sense of craftsmanship are here involved.

In acquiring these senses, or in improving them, if they are native to him, by the only means available—the measuring of existing buildings ancient and modern—the designer incidentally comes into possession of his traditions. In the language of the vulgar 'he learns the styles'; and if he is not very careful he acquires the habit of using certain mouldings in certain contexts without exercising either the sense of scale or the sense of craftsmanship. This over-indulgence in precedent has been the great fault of the architecture of the nineteenth century.

2. *Scale of Detail for Stone*

Bred in the classic tradition of St. Petersburg, and later having become learned in the lore of Greek mouldings, it fell to the writer's lot, as a pupil of the late Sir Robert Lorimer, to set out the full-sized details for the Playfair Monument which stands on the links at St. Andrews. In due course the master came to the board, extracted a BB pencil from his pocket and redrew the cornice section with a heavy juicy line. Then seeking to test his pupil's progress in the mystery of architecture, he demanded a frank opinion of the change. And frankly he was given it: 'Clumsy.' To which the master replied, 'Well, some day you will realize that *clumsy* may be a very fine quality in architecture.' The matter has never been put more clearly. That pupil has since climbed many a spire and hung over many a cornice to find out just how clumsy the great masters have sometimes found it necessary to be.

It is not only the depth and projection of mouldings, but their articulations, curves, beads, facias, and fillets that must be largely regulated by their position—their actual distance from the normal beholder and their actual place in relation to structural elements and surfaces. To produce a given effect the farther they are from the eye of our old friend 'the man in the street' the simpler they should be in contour and the coarser and bolder in section. Both size and the degree of simplification, or complexity, will be affected by the dimensions of adjoining members and elements.

Now if this were an engineer's pocket-book the writer might prescribe for the reader the size to make an archstone of given material, or a steel column of given quality to bear safely a given load, but he cannot prescribe to another designer the size and section of his mouldings. That must depend on the impression the designer desires his moulding to make. All that can be done here is to warn him that in certain situations the impression of a given section of given size will be quite different from what it would be in other situations. The young designer must find out by the use of his eyes and his faculties what degree of size, or refinement, or coarseness will be appropriate to his intention in any given case. If he overdoes his mouldings his building will suffer in apparent size; if he underdoes them it will suffer in force. He may be quite prepared for such sacrifices, or he may desire above all things that the building as a whole should not suffer at all in these respects. Assurance and confidence in detailing should be the result of knowledge and experience; they are too often the result of ignorance. Without knowledge there can only be luck and accident as to the impressions produced.

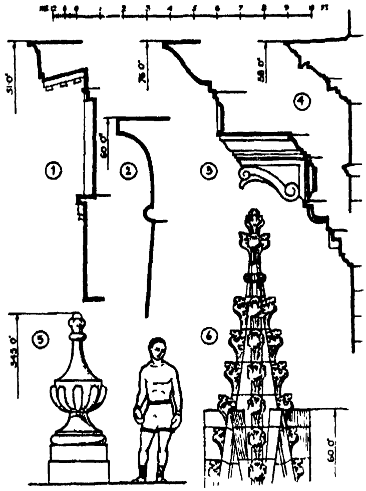

FIG. 156.

1. Parthenon.
2. Temple of Khons.
3. Riccardi Palace, Florence.
4. McGill Union, Montreal.
5. Finial, St. Paul's.
6. Lincoln Chapter House.

Cornices and finials illustrating the scale of masonry details.

Now the designer's knowledge may be intuitive genius, natural talent, or instinct; if so, experience may be of less account. There is a wide gulf between being an artist and supposing or hoping that one is an artist. Nothing in the whole realm of art is more personal and individual than a designer's mouldings.

So far we have been considering the effect of distance and position on mouldings so as to make them 'read'. Division of mouldings into members or groups of members makes it possible for them to 'read' well at varying distances. The groups stand out as distinct elements with their subdivisional members merged at the longer distance views. Enrichment of members is for effect in the nearer views. When clarity is the aim enrichment is confined to shaded members; practical considerations, such as the effect of weather, encourage the avoidance of enrichment on exposed members.

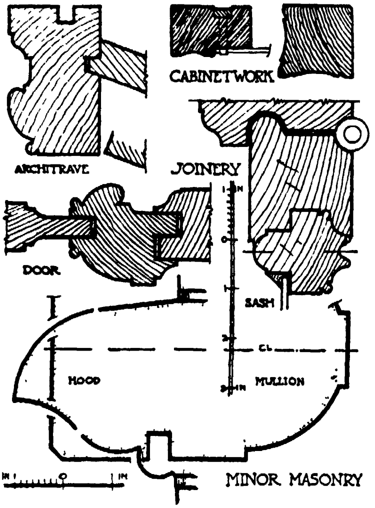

FIG. 157. The scale of detail in cabinet work, joinery, and minor masonry.

3. *Scale of Detail for Wood*

Size in wood mouldings has a smaller range than in the case of stone, for the reason that very large buildings are not usual in wood construction. Broadly speaking, there are three general scales applicable to wood construction and consequently to the mouldings related thereto—the scale of carpentry covering exterior woodwork generally, and the interior woodwork of open roofs and such-like structural elements; the scale of joinery applicable to windows, doors, wainscots, and so on; and the scale of cabinet work and movable furniture.

In the cases of joinery and cabinet work there are further considerations—touch and wear and tear. The intrinsic character of a moulding suffers if it is battered and dented. Touch is really a matter of use and purpose—the test of comfort. The feel of mouldings subjected to handling is important. Sharp projections, where a head may come in accidental contact with them, may render a mantelpiece or a book-case an uneasy companion of one's days. The art-nouveautistes of nineteen-hundred were obsessed with the spirit of 'haunting sprightliness' which they knew very well how to embody in their joinery and cabinet work; but at the price of many a cracked head and dinted arris. Their successors of to-day know very well how to give expression to a hysteria of brutal angularity which has its own inconveniences. One may fully appreciate their successful artistry while deploring their lack of gentility. Again to quote Sir Robert Lorimer, for whose private house the writer had set up some details, 'I see you've been enjoying yourself, but don't forget I have to live with these things.'

4. *Material Considerations*

Now what of material considerations? Obviously when mouldings occur in hard, or brittle, or coarse-textured, or soft stone these characteristics of the material will have their say. Cost of cutting may be a consideration. Lasting they must be, unless one desires the kindly hand of time to soften the acerbities without delay—a rare contingency. The client who wants a ruin is out of his mind. Deep undercutting may be out of the question in certain materials and effect must then be obtained by other means of emphasis in light and shade.

It is colour, however, which deserves most attention as a material consideration. A dark-coloured stone is not appreciably darker in the shadow than a light-coloured one, but the contrast between the lights and shades of a dark stone is far less than in the case of a light-coloured one. For equal effect dark stones demand crisper sections, with broader fillets and deeper undercuts, than light ones. Where veined or mottled stone, such as variegated marble, is concerned, sharp lights and shades only serve to kill the intrinsic colour interest of the material. Here soft broad sections that enhance the figure are appropriate. White marble is perhaps the most sensitive material the designer has to deal with. In virtue of its fine texture it can be moulded with great precision and sharpness, but its transparency demands a certain largeness of handling. Sharpness and sweetness must not be allowed to degenerate into finicky smallness in a material that casts thin shadows. Plaster, on the other hand, which is both white and opaque, gives the greatest definition of light and shade of any material used in construction. The ease with which very sharp and intricate mouldings can be run in this material, so long as they are not undercut, often tempts the designer to indulge in sections that, in execution, prove startlingly forcible. For plaster details a certain softness of contour is therefore advisable.

5. *Process*

In the elaboration of all detail the knowledge of how things are made, of what is possible, of what is easy and natural, of what cannot be done, is of the highest importance. The practical and economic aspects of what has just been said are so obvious that they need not be dwelt on for a moment. The inspirational aspect of technique has already been referred to again and again, but a writer on design need have no hesitation in availing himself of every opportunity to do so. It is of the very heart of the matter.

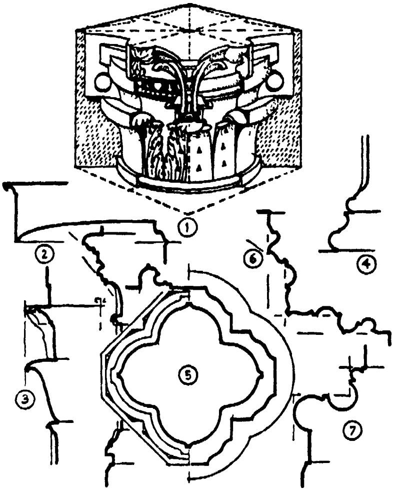

FIG. 158. The effect of bankering and jointing on the detail of masonry.

1. An Italian capital. 2. A Greek cornice. 3. A Greek capital. 4. A Greek base. 5. A Gothic pier, arch, cap, and base. 6. A Gothic archmould, middle order. 7. A Gothic water base.

How is a moulding cut in stone? First, the stone is squared; then the section of the moulding is traced on the ends and all fillets or faces reaching the surfaces of the block are marked out. Other faces are then sunk or relieved. To find the boundary lines of members, bankered faces, oblique to the squared faces of the block, are then cut down; on these faces the boundary lines of members touching them are in turn traced; further sinkings and relievings are then carried out; finally the flat and curved surfaces are dressed off. When a series of mouldings involves several courses, as often happens in the case of cornices and archivolts, the beds may be regarded as part of the banker-work. The coursing and bankering is broadly determined by the character of the moulding, but the coursing and bankering in turn largely determine the detail of the moulding. From the practical and economic point of view the broader and simpler the necessary bankering can be, the better. It is extraordinary how simple the geometrical construction for contours of the most complicated Early English Gothic mouldings are found to be on analysis. Nowhere else than in England and in no other period have mouldings played so great a part in design. This simplicity in the general structure of the section has precisely the same kind of expressional value that simplicity of general structure in a complex sentence has—each clause is clear. The grouping of the minor members, above alluded to, is grammatically achieved.

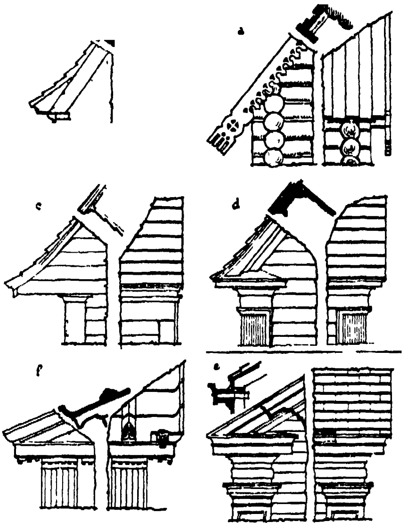

FIG. 159. Verges and Eaves.
a. Russian log cabin. *b*. Surrey barn. *c*. French Canadian cottage. *d*. Colonial house, *c*. 1790. *e*. Nova Scotia house, *c*. 1825. *f*. Greek Doric temple.

Examples to illustrate the interaction between constructional and conventional forms.

In the design of wood mouldings a similar systematic technique makes for clarity, but here it is not the material but the knives with which the mouldings are run that are reduced by a process of relieving and bankering performed on the grinder. The sharp re-entrants which are easy in stone are, however, difficult, not in the wood, but in the knife that cuts the wood—difficult to form and difficult to keep sharp. For mouldings in wood the character of the material must also be taken account of, as in those for stone, but chiefly as it affects the knife. Straight grain and even texture facilitate both refinement and depth. The harder materials are susceptible of smaller membering than the softer. Harsh grain demands breadth.

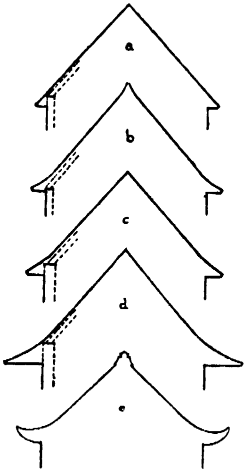

FIG. 160.

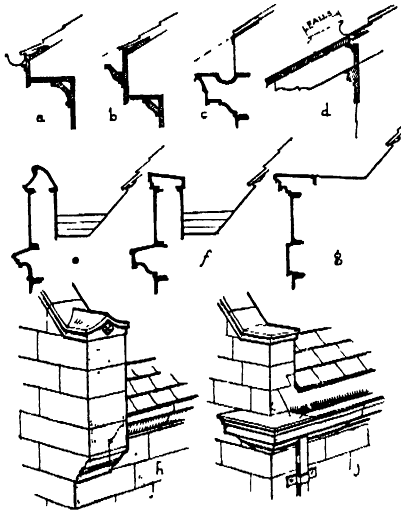

FIG. 161.

FIG. 160. Gable Forms.

a. Eaves formed below wall head. *b.* Sprocketted eave at wall head. *c.* Sprocketted eave below wall head. *d.* French Canadian bellcast. *e.* Chinese bellcast intensified at corners.

FIG. 161. Weather and construction determining form.

a, b, c, d. Gutter forms. *e, f.* Parapet forms. *g.* False parapet for snowy climates. *h.* Corbelled skew-put stopping eaves-course. *j.* Skew-put stopped over cornice.

Mouldings in metal-work are profoundly influenced by the process to which the material is subjected, and there is often option where metal is concerned as to the process that will give the desired result. Where the lathe is invoked directly (or indirectly in the preparation of patterns for casting) very great precision and delicacy are readily achieved. Of pattern-work generally, it may be said that whatever can be done in fine joinery, or plaster-work, can be reproduced in casting. Where hand modelling or the waste wax process is involved, a certain softness and lack of precision is natural and proper. Extruded mouldings are naturally characterized by great precision. In beaten and pressed metal-work, mouldings are necessarily lacking in sharpness and very simple in section. In all metal-work to be rubbed up and polished, extreme high lights may be counted on, and very moderate articulations suffice to explain themselves under these conditions.

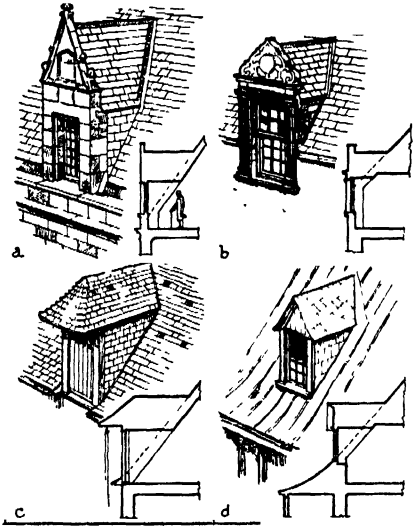

FIG. 162.

a. French dormer gablet.
b. Scottish dormer.
c. Surrey loft door dormer.
d. French Canadian lucarne.

Note the relations of floors, wallheads, and eaves that determine the forms.

6. *Stopping Mouldings*

A few remarks on how to get rid of a moulding, when done with, may be in order. When a cornice goes all around a building, or a capital all around a column, it has upper and lower limits, but no ends, other than the points where it passes out of view. A moulding is said to 'return' when it changes direction in its passage around a member; the most usual return is an affair of 90° either in the vertical or horizontal plane—a panel-mould returns around the panel, and an entablature returns around the salient or reentrant angles of a wall or colonnade. After returning a moulding may be 'stopped' on a wall, or surface, on which the structural element, with which it is associated, stops. It is said to 'return on itself' when the return with a stop is made independently of any stop of the element with which it is associated, but on to that element itself. A cornice, for example, may traverse the side of a building, return on the quoin of the building, continue for a short distance, and then return on itself, so coming to an end independently on the side wall.

Stops of mouldings may be contrived in several ways. The moulding may be run out to a 'stop', revealing its own section. This was not infrequent in the case of hammer-beams in Gothic-framed roofs. These often ran out and showed the symmetrical figure of their double-moulded sections; sometimes they did so on a splay, the better to reveal the figure as seen from below. Such stops were sometimes masked with escutcheons or angels—that is to say with ornaments—but were often left to tell their own story.

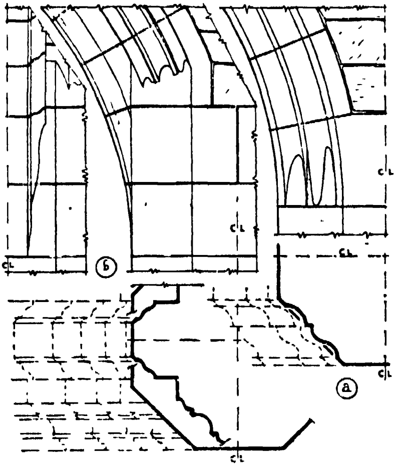

FIG. 163.

a. Archmould dying 'sweetly' on splay of pier.

b. Two ordered archmould, one dying on inner face, and one dying on splay of pier.

A moulding may be stopped on a special feature designed to stop it, or on a feature that conveniently occurs. A cornice, for example, may stop on the skew-puts in a case where it is associated only with the horizontal eaves of a gabled building having skews on the gables; or it might stop on corbels projecting for that very purpose.

The stop by gradual 'death' on a member or structural element, other than that with which the moulding is primarily associated, is a device very fully exploited in medieval architecture. The false logic of this method was eventually carried too far, leading to the interpenetration of mouldings with mouldings and reappearances. In this one suspects a deliberate creation of geometric perplexities for the pleasure of overcoming them. This confusion is a disease of form. It may be diagnosed as preponderance of technique to the point where synthesis became impossible—in common parlance 'too much vinegar in the salad-dressing' preventing emulsion.

The disposal of minor members by interpenetration or dying on major ones need by no means be restricted to essays in the medieval manner. The principles involved in letting a moulding die may be exemplified by taking the case of an octagonal pier from which arches spring. If the wall above is thicker than the pier and the archivolts, face to face, at the spring give a width greater than that of the pier, the mouldings of the arch cannot all die on the pier. A capital would be required to take up the difference. But suppose the wall above and the pier to be of equal thickness; then the faces of the wall will be continuous with two of the faces of the pier. Now, if the plan at the spring, extending face to face of the archivolts, corresponds angle for angle with the plan of the pier below, then the intrados and splays of the arch will also be continuous with the corresponding faces of the pier. They are said to 'die sweetly on the pier'. The archivolt may still be modified with mouldings sunk to any extent within the general contour above defined; all parts of these mouldings will then either interpenetrate with the shaft of the pier, or die upon it. Should the spring of the arch, or of its outer order, be above the centre from which the arch is struck, the mouldings need not be confined at the spring within a section generally similar to that of the pier: so long as they are confined within the thickness of the wall, which is the same as that of the pier, they will all die; but not sweetly.

When mouldings are designed with an intention to dispose of them in this way, consideration should be given to the trace of the interpenetration that must result. It is impossible to execute with precision—that is to say to enunciate clearly—an interpenetration involving forms which lack sufficient contrast; especially is this so when the interpenetration occurs at a very oblique angle, as is usually the case. The geometrical figures that interpenetrate should also have some consistency, the one with the other. In the case of the octagonal pier above alluded to, confusion would arise if a quoin of the pier ran up into a hollow of the archivolt.

7. *Jointing of Mouldings*

When mouldings die on members by interpenetration, the mason joint is always involved. By this is meant the working of the death of the moulding on a piece that is integral with the surface on which it dies. This arises inevitably in masonry where the mitred and coped joints are impossible. In joinery, returns and returns on self are readily made by the use of mitred joints and cut stops; but, even in joinery, when a moulded member dies on a splayed member, or on another moulded member, the mason joint is the best and most significant construction. The 'coped' joint, in which the two moulded members have an actual joint line at the abutment of the one on the other, is an inevitably inferior and less neat construction. Economy is its one recommendation. If one cannot afford a mason joint for the death of a moulding it is better to arrange otherwise and not pass sentence of death upon it.

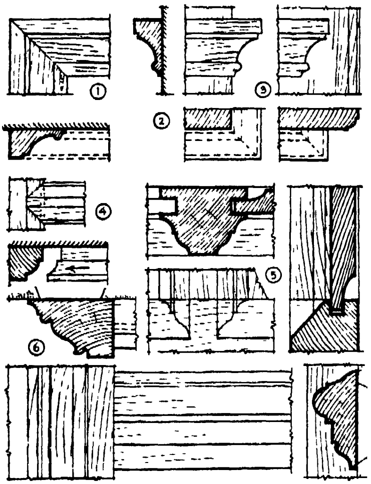

FIG. 164. The disposal of mouldings in joinery.

1. The return around. 2. The return. 3. The return on itself. 4. A coped joint showing returns around. 5. The mason joint of a moulded style on a splayed rail. 6. The butt joint where one moulded member takes another on its back.

The cross-jointing of moulded archivolts and the vertical joints of horizontal mouldings have great value in showing the contours, or sections, of the moulding. When that is desired, they elucidate the geometry. The section, as has been said, is not a thing to wax enthusiastic about as a line on paper regardless of its meaning, but, when it is well-conceived with due consideration for its determinants, it is appropriate to reveal its form and excusable to revel in the revelation.

The view has been seriously advanced that 'from the designer's standpoint a moulding is but a means of drawing a black brush mark across the face of a wall . . . all are but charcoal streaks with which we draw our design'.[1] This seems an altogether perverted way of looking at the matter, although perhaps a fair enough deduction from the thesis that architecture is 'the fundamental art of inventing and constructing objects that please by their intrinsic form and colour'. We have laboured in vain if the reader is under any illusion that this attitude of mind offers either a basis for his procedure, or an explanation of his activity, when the designer becomes artist and discovers form that transmits his mood. 'Brush marks' and 'charcoal streaks', indeed! When the shades and shadows cast by mouldings vary every hour of the day and every day of the year. No designer worthy of the name ever placed a moulding just to please, or determined its depth, projection, and contour just to give so much shade and shadow. The shade and shadow, ever varying, enable him to reveal the form; and if he can use another means, such as jointing offers, for the better elucidation of the form and the impression the form provokes, he is wise to take advantage of it. Jointing has often been used to reinforce the message of light and shade as to the form of mouldings in stone, and very properly.

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[1] John Beverley Robinson in *Architectural Composition*.

It may here be observed that, long before the last gasp of French Gothic art at Abbeville, signs were not wanting that craftsmanship (as evidenced in the jointing of executed works) was being relegated to a subordinate position in French design. The doctrine of the pre-eminence of the problem over all other considerations, which has been at once the strength and the weakness of the training given at the École des Beaux Arts during the last hundred years, had already taken root. The position here adopted in regarding material and technique as co-partners of purpose, not as its servants, has, it is to be hoped, been made abundantly clear already. Whatever else the Gothic revival in England may have brought about, it succeeded in reaffirming this principle, which had at no time become wholly obscured in the minds of English designers. If Wren never had occasion to put it into words, we need only examine his executed works to realize that he took it for granted.

8. *Characteristics of Detail of Various Periods*

A few remarks on the characteristics of the minor elaboration of form, particularly with respect to mouldings in the architectures of different periods and places in the line of the traditions we inherit, may here be in order.

The Egyptians over a long period of time evolved very few mouldings, all of a very simple character; their origins and translation from one material to another are not of interest just here; nor is it necessary to enlarge on the conservatism of Egyptian culture. It may, however, be observed that the breadth and simplicity of Egyptian mouldings were consistent with the fact that they were habitually enlivened with painted decoration.

Strong light and fine materials encouraged the Greeks to exercise their acute minds in the exploitation of subtle curves and crisp incisive members in their mouldings. The precision of these curves is suggestive of the general use of mechanical devices for their geometrical development; most of the sections from the later Greek period have on analysis been found to be based on regular geometrical figures—conic sections, helical curves, and so on. Simple circular sections occur in beadings and minor members for the most part. Free-hand and eye-drawn curves may occur as approximations to mechanically set out curves. Fifty years ago archaeologists generally took the view that these curves were evolved by hand and eye, but much evidence in a contrary sense has been accumulated since.

The Romans were quite content to use simpler forms; for them the T-square, the set-square, and compasses sufficed; and their reversing curves usually stop where the radius becomes horizontal or vertical. There is always a brusque simplicity about the setting out of Roman mouldings.

Byzantine mouldings, when contrasted with the subtle crispness of the Greek, or the firm simplicity of the Roman mouldings, appear blunt and soft. They are sparingly employed; but put them in their proper context of a structural system in which vaults and groins and domes could make only loose approximations to regularity of figure, and in which wide wall surfaces were sheathed with figured marbles: their deficiency of sharpness then becomes a positive virtue in harmony with the major elements which they serve to demarcate.

The Romanesque period—a mere mixture of Roman and Byzantine decadences, but with some promise of the medieval inventiveness that was to come—may be passed over. The characteristics of Cistercian architecture in England during the thirteenth century, when the elaboration of functional detail in mouldings reached a climax never attained before or since, must, however, claim serious attention. The fact that other kinds of adornment were incompatible with the ascetic spirit of this powerful order may largely explain this concentration of ingenuity on architecture as its own subject. The invention of technical devices for undercutting hollows is not to be ignored however. The grouping, or ordering, of intricate series of mouldings by courses and shaftings, exercised a control without which mere riotous intricacy might have resulted.

Deep hollows contrast with beads and botels and keel-moulds in concise groups. The execution has only a moderate degree of geometrical precision. From the innumerable reconstructions of the setting out, derived from measuring, it is safe to say that no mechanical devices other than the square and compasses were used in establishing the curves. Hand and eye work was resorted to when curves departing from the simple circle were involved. Probably the procedure was to draw the whole moulding by hand and eye, within its frame of lines for bankered stone, and then improve with compasses those curves which it was decided to make circular.

The later Gothic mouldings have a different character, due in no small measure to the emancipation of much artistic energy in ornament and decoration, consecrated to things other than the glorification of structure. The evolution of mullioned and traceried windows had its part in the change; for it was in this field that the strict ordering of mouldings by fillets, as distinct from joints, came about. This filleting of shafts and botels is a distinguishing characteristic of the later Gothic mouldings. It endows the structural elements, thus elaborated, with a crisp systematic sobriety that serves well as a foil to the exuberant variety of form that manifests itself in the ornament. The undercut hollow in the solid tends to disappear, although the three-quarter circle hollow to mask the joint persists to the end.

Throughout the period of revived classicism the Roman practice has generally been followed in the setting out of mouldings. To this the architects of the Italian Renaissance made a contribution, in the way of refinement, where reversing curves are employed. This consisted in carrying one or both of the segments beyond the point where its radius would be square with the main vertical face of the fabric. This swinging ogee in certain positions takes more light and shade than the normal curve; but it is a refinement hardly worth while in the shaded bed-mould of a cornice, though valuable in profile.

In the abortive Greek revival of the early nineteenth century, Greek subtlety was often attempted in the elaboration of detail under northern skies and in materials which would hardly have stimulated such effort in the Attic mind.

While the functional elaboration of detail has ever tended to become systematic and codified for the exposition of purely structural fact and fancy, it may well be borne in mind that in origin these elaborations are always found to have been matters of practical utility. Invention thus becomes convention in deference to habit. This process goes on as structural method changes and new purposes generate new forms. The 'stuck moulding' run on the solid frame of a panel becomes the planted moulding sprigged or glued to the frame. The weatherly hood-mould becomes the trimming of the internal arch. The cornice, once the eaves of a sloping roof, becomes a water-table for the protection of the wall-head or of lintels associated with columns.

Now, in form, as in speech, there is a point beyond which convention ceases to have expressive value degenerating through the trite and the banal into mere shibboleth. The misuse of traditional forms, once they are used for their own sake, is the most frequent source of weakness in the elaboration of detail. This is most commonly in evidence in interior work where details are so often employed that might mean something outside in stone and can mean little, or nothing, inside in wood and plaster. Here they cease to be apposite unless substantially modified. The interior detail of the Dutch is generally singularly free of this vice; particularly so in their work of the second half of the eighteenth century corresponding to the period of Louis XVI in France.

9. *The Designer To-day*

In conclusion, it is appropriate to ask what is the position of the modern designer as heir to all the detail of all the ages. He is faced with modern construction, modern economic stress, modern cultural taste—based on little knowledge of many things—and above all with the lack of that conviction on which designers in the past could rely when taking their part in the evolution of their more strictly limited traditions. All these circumstances point to a very moderate indulgence in the elaboration of detail. If he is not to be permitted to make his structures very glib about their own affairs, there is the more reason why he should see to it that what they say is well said. To be laconic is by no means to be inarticulate. The words of those who say little often come with all the greater force.

From the ways of the Greek, the Latin, and the Goth the modern elaborator of detail can deduce some useful principles for his guidance. It is these and not their actual ways of handling detail that can help him. Perhaps his best course is to pick up what tradition he can find in the works of great masters of detail recently dead, or still happily with us, men who drew their mouldings with their own hands—Norman Shaw, Ludwig Hoffman, Stanford White, Bertram Goodhue, Edwin Lutyens. A full technical appreciation of the detail of these masters is not possible without some acquaintance in the ways of the Greeks, Latins, and Goths above referred to. The better one understands the traditions behind the work of such masters, the more personally characteristic their sections will be found.

Once the principle and practice for setting up sections for mouldings are properly understood, the less the designer has to do with copy books the better. The detail is lying there imbedded in the image of the block of stone, or plank of wood, or mass of plaster, or sheet of metal on his drawing-board; it is for him to find it there, taking due account of matters above discussed. If he realizes that when drawing a moulding he is putting a phrase in the mouth of one of his characters in the very dramatic business of construction, he cannot fail to realize that in so doing he is revealing such feelings as he has as to his characters and how they comport themselves. Stout piers, slender shafts, high walls, squat arches, broad plinths, sturdy lintels, and massive buttresses; he can make them play their parts with serene assurance, or with much ado; debonairly, or stolidly; with smiling inconsequence or busy preoccupation; just as he will, if he knows how. That is architectural detailing as art. One word of caution: adjectives and adverbs are very inadequate implements with which to re-fashion the moods and humours of architectural form. Draughtsmanship is the only reliable medium, and even that is far from adequate unless accompanied by the ever-present image of the thing delineated in the stuff to be wrought.

XXV

THE GRAPHIC ARTS

1. *Graphic Expression*

THE position of the draughtsman and the painter differs somewhat from that of the designer, so long as they all content themselves with mere expression. When they indulge in artistry their positions are analogous. The designer seeks form—synthesis of purpose, material, and technique—and then as artist he may proceed to elucidate the form he has discovered. The draughtsman and the painter also seek form, and then as artists proceed to its elucidation. The designer's search is for the solution of a problem —he creates form; the draughtsman's and the painter's search is for form already created in nature and in the works of man; they recognize form.

What the draughtsman and the painter do with ready-made form and what the designer does with form he himself creates, when all three become artists, is fundamentally the same. The graphic artist's elucidation, like that of the designer become artist, involves some sacrifice in the integrity of the basic form that is his subject-matter, in exchange for the elucidation. The draughtsman or painter, projecting on a plane, creates a new form which is a commentary on basic form. From that point on, his processes of expression and artistic activity are parallel with those of linguistic method and design.

Elucidation, comment, description, call it what you will, it is that which opens the way for the draughtsman and the painter, as artists, to invest expression with emotional experience. When the draughtsman or the painter confines himself absolutely to representation—reconstruction of the appearance of things—by exercising his skill to achieve the fullest degree of verisimilitude of which the material and technique at his disposal are capable, he is a mechanic not an artist. Without mechanical skill of an order high enough to admit of his doing this, he can only be an artist in intention. Failure of faculty may readily be mistaken for that preliminary part of artistic action which involves sacrifice of integrity. In very plain English, the draughtsman must know how to draw correctly and the painter how to paint consistently before either can succeed in taking those liberties of omission and commission out of which his comment is born. Visual analysis and manual dexterity are the prerequisites of graphic expression; facility in graphic expression is the prerequisite of graphic art. One must be a good craftsman before one can be an artist at all.

There is special need to cogitate on the substance of these observations at a time when the anarchic spirit baulked, for the time being at least, in its assaults on the commercial and political structure of society, has made serious inroads on the fields of art and culture, with the result that gross incompetence is hailed as originality and crass ignorance as the new knowledge. There is probably just as much sheer talent in the world as ever there was, possibly far more, but the critics and certain 'schools of art' have much to answer for in its suppression by the creation of an artificial environment all too favourable to the moron.

2. *Drawing*

What are the conditions and limitations under which drawing and painting are achieved in the field of graphic expression? Drawing consists in intercepting on a plane what is, could be, or might imaginably be seen; this involves as a first step demarcations to indicate the projected contours of objects in space, or conceived as in space. To the contoured figures, thus produced, a further indication of the solidity of the actual objects and of their relative distances from the eye can be added by the representation of shades and shadows of appropriate strength, or relative value. The range of values actually seen may be far greater than the range of which white paper and black chalk are capable under an illumination of from twelve to twenty foot-candles—comfortable lighting. This actual range may be one hundred, or one thousand, times as great. The light and shade in the several parts of the drawing must therefore be relatively apportioned, either between the available extremes, or about an arbitrary value, above or below which scales of variation may be condensed, simplified, or ignored. If a certain grey is to represent a given shadow, all other lighter and darker greys, for other values, must conform thereto systematically. The system may be highly conventional, but the convention must necessarily be based on facts of experience. By convention one may ignore cast shadows, or ignore the intricate modulations of shade that are revealed in the fact, or one may ignore both. When both are ignored there is a line drawing.

How far colour can be represented in a drawing by blacks, whites, and intermediate greys is worth considering. Spectral hues of full saturation vary in luminosity as has been seen. The red is only about one-tenth as luminous as the yellow, and ten times as luminous as the violet. Tints, tones, and shades of the spectral hues involve further changes in luminosity from the parent hue. The less the luminosity of the local colour of an object, the less range between its high lights and its deep shadows. The degree of luminosity of a local colour can be represented in an uncoloured drawing; but the basic hue of the local colour cannot. Common knowledge may, however, be relied on to suggest to the beholder of the drawing what some of the colours present in the fact, or fancy, were, and, once these are established, other colours can be inferred. Dana Gibson, in his inimitable portrayals of 'The Education of Mr. Pipp', succeeded in going as far as it is possible in showing colour in black and white work by means of modified scales of values and reliance on our common knowledge of the colour of the things he drew.

The range of 'light and shade' (highest light to deepest shadow) upon an object, as seen, depends largely on distance from the eye —the farther away the less the range. Usually there is diminution both of light and of shade, especially in humid or hazy atmospheres; but, under certain conditions of diffused light, the diminution is restricted to the shades and shadows only. Local colour is also modified by distance; usually towards the blue of scattered light, but sometimes to a neutral tint due to the merging of the optic images of colour reflecting surfaces diminished by distance. However, the horizon may show hard and dark when looked at towards a source of light. It may show light because of a reflecting surface such as water or snow, or because there is more diffused light at a distance than near at hand. The distance can never manifest strong colours other than the blues and violets.

3. *Linear Perspective*

We may here remark of all drawings that their confines represent the limits of the field of clear vision in a general way. The thing, or group of things, looked at or imagined as having been looked at, and represented on the drawing, must occupy the centre. There may be many things represented, but what is centrally shown is that to which the regard was actually, or theoretically, directed, even if what is centrally shown is the edge of an object, or the vacant space between two or more objects in a group. There is thus in any drawing a central area inhabited, so to speak, by matters of importance; outside this all is more or less subordinate. The drawing is a reconstructed field of vision with the point of regard somewhere on the central vertical axis; usually about half-way up. One looks at or towards a thing under contemplation; and one is dimly conscious of other nearby things affecting its appearance. What few useful precepts and conventions there are, with respect to composition and balance in what is shown on a drawing, all hang on this.

The scale on which a drawing is made has a bearing on what, or how much, it embraces. Beyond a visual angle of 60° definition is lost; within an angle of about 5° it is homogeneously clear. Drawings reconstructing a visual field usually embrace an angle of 40° to 50°. A 10-in. drawing intercepting the visual field at 14 in. from the eye embraces the same subject-matter as a 10-ft. drawing intercepting at 14 ft. but on a different scale; a figure showing 1 in. high on the one will show 12 in. high on the other. A 10-in. drawing intercepting at 14 ft. gives only a small fraction of the visual field. If brought nearer the eye it becomes an enlargement; the point of sight for its perspective is then behind the eye—so the drawing now represents to the eye something bigger than the thing originally drawn.

Now suppose one looks at an object (say a pile of rectangular books) 9 ft. away and draws it as seen and at the size it would be intercepted on a plane where the paper is, say 18 in. from the eye. Bring this drawing in to 12 in. from the eye and it then represents an object of a different form (the books so shown are not rectangular, and they are narrower than the real books); next, place the drawing 30 in. from the eye, and it now represents an object again different in form (the books so shown are wider than the real books and their rectangularity suffers, but in a contrary direction).

If a drawing is so wide that it embraces several contiguous visual fields, then it represents what can be seen successively by traversing the eye horizontally—the centre point of the regard has become a row of points, and successive objects cannot be correctly represented by a construction of the drawing based on only one central point of regard.

Whether one is making a drawing to be seen at 10 or 12 in. from the eye, or to be seen at 10 or 12 ft. from the eye, one is normally concerned both with seeing what is drawn (figures and colours, on paper) and seeing what is represented by the drawing (the subject) as at a certain distance from the eye. Linear perspective and aerial perspective are invoked to give the sense of distance away of the thing represented; both must be related to the scale of the drawing as well as to each other. Thus every drawing has a proper distance from which one can best realize what is represented; the distance from the eye at which the drawing was actually made may be quite different—normally far less.

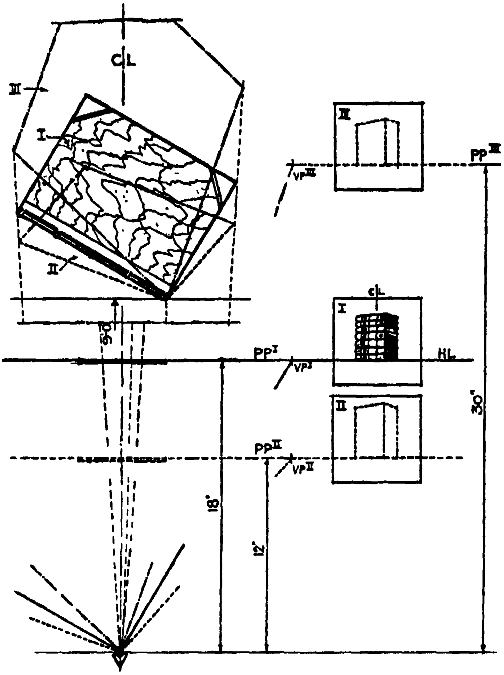

FIG. 165. A perspective drawing of an object can only be a true representation of the form when the drawing is looked at from one particular distance.

I. The drawing in question seen at 18″ represents rectangular books as at I.

II. Seen at 12″ it represents books shaped as at II.

III. Seen at 30″ it represents books shaped as at III.

It is not proposed to describe with any elaboration the several methods of developing the underlying structure of a drawing. It will be enough to enumerate some of the systems available.

With the eye conventionally assumed as at an infinite distance from the object there is projection in one direction. When this direction is at right angles to a plane of the object, this plane is shown in true elevation; a plan is just a special name for an elevation from a vertical direction. Parallel perspective involves one or more vanishing-points, usually within the boundaries of the view, and the convention that parallel lines in planes at right angles to the line of regard are shown as parallel. The usual application of this method is to interiors and to groups of buildings set out on a rectangular basis. Ordinary linear perspective involves a vanishing-point for every non-vertical line, or group of parallel lines, that occurs; and the convention for vertical lines that they must all be shown vertical. Like the other systems, this gives an approximation to visual fact; in this case a close one. Only by spherical perspective do we reproduce the true image on the retina. The conventional systems of linear perspective have the advantage of showing lines straight which the *whole* visual process interprets as straight, without regard to the fact that in the visual image only straight lines passing through the centre of the field of vision are straight, all other straight lines having curved images on the retina.

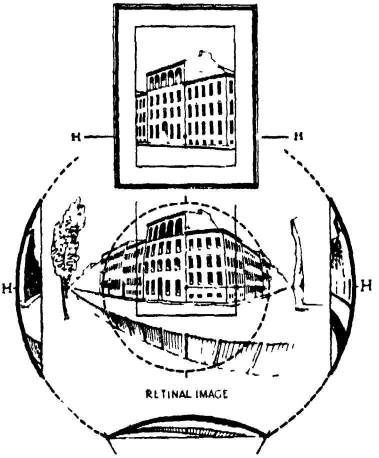

FIG. 166. A perspective drawing is a conventionally simplified version of the retinal image, but it is closer to experience than a representation of a retinal image would be. One is never conscious of the optic image as a whole.

Objects, such as the human figure, which do not consist of an agglomeration of rectilineal figures cannot be drawn without something in the way of a geometrical analysis reducing them to a system of straight lines, the establishing of a centre point at which the eye is directed and the invocation of systematic perspective of one kind or another, with the acceptance of such conventions as the system selected may demand. Spherical perspective, of course, gives the closest approximation to retinal image, but not to visual experience.

The figures traced upon the paper to represent an object are out of drawing, faulty, wrong, if they are inconsistent with the representation of the facts in accordance with some system based on visual experience. When consistent they are right. Consistency with any system of linear perspective leads to increasing distortion as the visual angle from the centre of regard widens. Compromise to overcome such distortion by an approximation to spherical perspective is then often resorted to, or things may be drawn as they would be seen by traversing the eye, that is to say, assuming successive central points to which the view is directed.

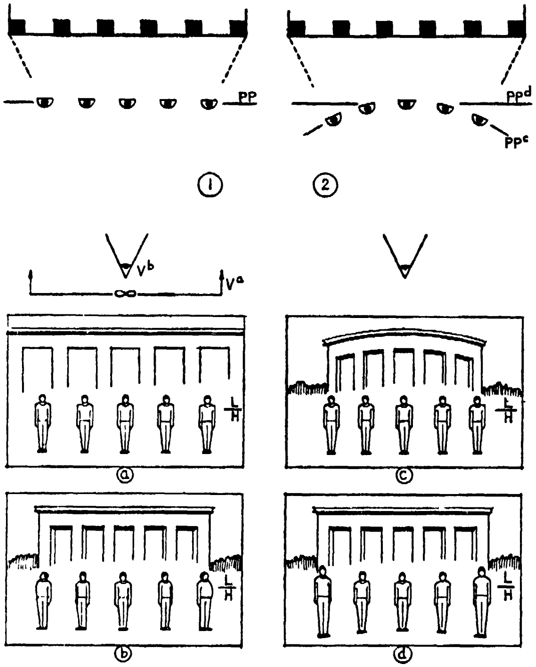

FIG. 167.

1. Five sergeants in line before a portico.
2. Five sergeants equidistant from the eye before a portico.

The traversing panoramic camera shows a semicircle of figures equidistant from the instrument as a straight row of persons to one scale; it shows the straight wall-head of a building behind them as a curve, while possibly preserving the convention that vertical lines do not vanish to a point above the camera. The ordinary camera shows the wall-head straight (and horizontal if at right angles to the instrument) the horizontal dimensions of windows increasing from the centre outwards and the semicircle of people as a semicircle with the height of the figures increasing to the ends of the group. If the figures are standing in a line parallel with the wall, they will show as a line of persons to one scale in height, but the figures at the outer ends of the group will be shown disproportionately broad in the photograph, i.e. varying in scale horizontally.

Good drawing then is drawing which is throughout consistent with the system invoked; and for any given subject one system may be more appropriate than another and the drawing be so much the better.

4. *Verisimilitude and Imagination*

Verisimilitude depends, of course, on good drawing, but, when drawing becomes the vehicle of art, fidelity to an object before his eyes is no longer required of the artist; but without fidelity to the system he selects he cannot represent the form he has conceived. When one remembers that nothing not once in experience can find its way into the imagination—that imagination, even when most original, is a piecing together of new images out of old ones—one may go so far as to say that without ability to draw systematically no one can either remember or imagine the two-dimensional images of three-dimensional objects.

When an artist sees fit to draw athletes with much longer legs, slightly longer arms, and very much smaller heads—all with respect to a normal torso—than any human being ever possessed, one cannot just say that he is guilty of bad drawing. If the abnormal limbs he has conceived with the assumption of their symmetry, are so delineated that, whatever their pose or contortion, corresponding heels, knees, elbows, and shoulders are apprehended by the beholder as having corresponding lengths, bone for bone from joint to joint, his drawing is very good. Whether one appreciates his elucidation of the human form, specialized, as it might be, by twenty generations of inbreeding for athletics, is quite another matter. One must admit that, in so far as he did something more than draw an accurate portrait of a given athlete, or a general representation of a composite type (in either case a merely mechanical performance) he was an artist. His knowledge of anatomy and his skill as a draughtsman made this possible for him.

A draughtsman representing a normally symmetrical personage of average, or specialized type in such a way that under no system of perspective could the legs, or arms, or the two sides of the face be apprehended as corresponding with the fact or fancy, displays ignorance of anatomy or lack of skill as a draughtsman, or both. Such recorded lack of observation of things and the appearances of things is faulty drawing—if it is due to mere carelessness the fault is so much the worse. All that has been said and written about suppression and simplification and abstraction and conventionalization and the arrangement of the lines and figures on the paper does not justify bad drawing as a basis for good composition. The powerful draughtsman, when he becomes artist, knows very well how to dispose his facts and fancies as in real or in imagined space, so that their projection on the intercepting plane of his drawing will give the lines, or figures, on which he relies for the expression of his sentiments. It is the would-be artist, half charlatan, half quack, who puts his lines and figures on the paper capriciously and lets his men, beasts, trees, ships, and buildings, and even his rocks and stones suffer deformity. The artist, of course, may take liberties with his subject-matter to his heart's content, so long as he maintains the organic characteristics of the form, real or imaginary, which he represents; but he must draw what he represents in consistency with a system if he is to be understood. Whatever the system, it has its conventions; and in the case of drawing for decorative work the system may be highly conventional, involving corrections for foreshortening and curvature of surface and so on.

5. *Line Drawing*

Light and shade and shadow and local colour and projection have been discussed in connexion with drawing in general, before giving serious attention to drawing confined to the presentation of configuration by means of line only. Line drawing is not always simply a preliminary to fuller methods of presentation. With a drawing confined to line, selective elimination and systematic convention play their parts, even when verisimilitude is the sole aim. When line drawing is invoked to represent three-dimensional objects by means of two-dimensional figures, with nothing but demarcation of the boundaries of their several parts, or surfaces, as a means of suggesting depth and solidity, great reliance must be placed on perspective.

There are several ways of making a line drawing give a sense of depth and space by varying the weight or thickness of the lines. A line drawing in which all line is of one weight must rely solely on linear perspective to suggest solidity and depth. An old and sometimes convenient method, known as back lining, consists in using a light or thin line on the edges of illuminated areas and a dark, heavy, or thick line on the edges of shaded areas casting shadows. The tracing of the contours of shaded areas has also been resorted to, but this gives the impression of a drawing which is incomplete and still awaiting the addition of shades or shadows. Line drawing is always best when confined to the delineation of form without reference to shade, shadow, or local colour, notwithstanding the fact that form is revealed by differences of light and shade and shadow and local colour and value. Indicating shades and shadows by their contours is like doing sums by writing, instead of by the use of arithmetical and algebraic expressions—a cumbrous process.

Some line draughtsmen use lines of different thicknesses to indicate various degrees of difference in value. Clouds, distant hills, and so on are drawn in thin line; objects at intermediate distances in ever thicker lines, as the objects occur nearer to the eye; and close objects in heavy line. This is at least systematic, but the resultant close grouping of heavy lines in nearby objects, while readily interpretable as signifying relative distance, sacrifices the characteristics of objects unduly.

The most effective method of using lines of various thicknesses is in relation to the massive importance and grouping of objects. A figure is a group of objects or parts whether elaborately accoutred or nude. A heavy line surrounding the contour of the figure, with lighter lines for the demarcation of subordinate elements within the main contour, enables the figure to be readily apprehended as a whole. This method, combined with variation in the weight of line used for contouring nearby and distant objects, is always effective in differentiating masses and groups of objects.

Some draughtsmen vary the weight of a line from point to point in its course, losing it entirely where difference in value is non-existent or negligible, and weighting it heavily where difference of value is pronounced. This can often be done effectively in filling out detail within the masses, but the main contours of important masses lose their integrity by a line which seeks to accomplish such diverse objects as separating mass from mass or void, and indicating values at one and the same time.

Great judgement is necessary in the use of the heavy line. It is extraordinary how heavy such a line may be without disturbing the drawing, provided it is well placed. The placing is the difficulty; and here regard for values within the object defined by the line, rather than differences of value between contiguous objects, must be taken account of. Where the heavy line defines the illuminated profile of a face, for example, it must occur outside the edge; where it occurs on the shaded side of a neck, it may with advantage occur within the actual contour. A heavy line is rarely well placed half inside and half outside the actual contour. Usually its place is outside the contour, touching it.

6. *Painting*

Turning now to painting, much of what has already been said about drawing is relevant, in so far as the position, extent, and configuration of the areas to be laid in with colour, whether flat or graduated, is concerned. The use of colour is also governed by systems of control and arrangement. When these are ignored or outraged, expression fails. The systematic use of colour involves conventions based on the nature of colour vision. It will be convenient first to deal with the conditions for the effective use of colour as a means of expression in pictures, and to consider their applications and implications with respect to decoration later.

In connexion with shaded drawing it was observed that the range of light and dark in nature frequently exceeded by far the range of luminosity in a black and white drawing seen in a light of the strength which showed black and white work to best advantage. To appreciate full range of hue, as distinct from full range of luminosity, the light should not greatly exceed twelve foot-candles in strength and should be 'white', as explained in the chapters on colour vision. To give the impression of things, as seen in the strong light of out-of-doors, in a picture, to be seen in this much lower but more colour-searching light, the colours used must be relative among themselves. The landscape painter does not try to match the colours in nature: he matches the relations of nature's colours when it is his intention to reproduce impressions of the facts of nature. The phenomena of colour vision are at his disposal to this end. The impression, or sense, of a highly saturated colour in nature may be reproduced by the use of a pigment of very inferior saturation suitably related to other pigments when all are duly adjusted for the light they are to be seen by. The painter who finishes his work in the open air, under an umbrella, may achieve a perfect adjustment of light and shade and shadow and values, but his representation of colour must inevitably be feeble. It is only when he happens to do his work in a low light out-of-doors that he has a chance of so relating his colours that they will be seen to advantage in a picture gallery. A studio is the place in which to determine colour.

It was remarked above that there was a proper distance from which to observe a drawing so that it would be the thing drawn and not the drawing itself that was apprehended—the distance at which the system of the perspective in the drawing corresponded with the position of the eye of the beholder. In other words, the eye of the beholder must be at the 'point of sight' for the true illusion of space. The competent painter does his painting, both with regard to selection of pigment and degree of breadth in handling, with reference to this distance of the beholder's eye from the canvas. Consistency of colour with drawing in this matter of distance is the mark of the master of his craft. His point of sight for the drawing and his point of sight for the painting are the same. Incidentally, it may be observed that this is a rare accomplishment. It is common to find the painting done as from well within the point of sight of the drawing, especially in landscape. With the eye at the point of sight for a correctly painted picture, paint ceases to be paint and one sees the thing painted, not the picture.

A third condition involving system is the necessity for a scheme in colour. The reasons for this have been explored in the chapters on colour vision. Impression of colour is determined in part by the intrinsic local colour of the object, in part by the strength of the light falling upon it, in part by the colour of this light, in part by the presence in the visual field of other colours, similarly determined, and in part by the extent of the field any such other colour may occupy—all further complicated by coloured lights reflected from objects. Furthermore, colour impression changes its character while being apprehended. But the tangle is not so bad as it seems. Scheme comes to the rescue.

Short of making a painted representation of the solar spectrum in a white light and to be seen in a white light, the painter is never involved with all the colours of the rainbow at once. In nature, volume of predominant colour and the interaction of colours occurring out of the spectral order can be relied on to reduce the palette required in any given case to one, or two, restricted areas of the spectrum. The other matters just called to mind so resoundingly all actually tend to further simplification of the palette. The painter may use a full spectral wheel of colours in the course of a lifetime. He can get along with very few pigments on any given occasion.

Use may be made in painting of projected form and colour in full co-operation on equal terms; or, at his discretion, the painter may make either the servant of the other; in any case he has a double vehicle of expression at his command. The colour scheme may indeed be the main subject of a picture, the facts of colour being in this case of superior importance to the facts of form. While colour schemes necessarily fall into one, or other, of a strictly limited number of classifications, their 'possible' variations within these several classifications are infinite. Inside the structure of a scheme every grain of pigment used affects every other grain in well-ascertained ways—there is nothing fortuitous about cause and effect in colour, except in so far as ignorance may lead to disappointment or surprise. If one chooses, for practical purposes, to regard the various classifications to which colour schemes can be assigned as conventional systems, it must be with the reservation that they are not as arbitrary as the systems of perspective.

Colour schemes are neither good nor bad, better nor worse, in themselves without reference to what they represent; when such reference is instituted one may, if there is defect, remark a 'false note' in colour—false to the context. It is fatally easy to introduce a patch of colour that destroys a scheme; the result may be to bring about a scheme of another kind altogether inconsistent with what is represented; or to bring about two rival schemes in different parts of the picture, mutually disruptive and destructive of unity. What colours can be used in the several parts of a canvas with expressional effect is not a matter of taste or free will, but a matter of optical science. The artist has full freedom in selecting his scheme, but in its development he is governed by scientific laws, not rules of conduct. He may, if the occasion demands it, use crude colour in contrast or in harmony. He may convert a scheme of contrast into a scheme of harmony by the introduction of additional colours. He cannot sustain basic contrast and basic harmony simultaneously. Either, if involved, may be subordinate to the other. Without scheme there is anarchy and colour destroys colour.

One single colour impression may be the subject of a picture, a particular blue of the sea, perhaps. In that case the artist bends his efforts to support that blue by the appropriate modifications of all the other colours he uses. He may do this by the use of adjoining blues, or by the use of opposing orange, or by both with one or the other prevalent. Magenta and green cannot help him; they will inevitably hinder him in this case.

It is when painting is used with decorative intention that colour scheme tends to assert priority over delineation. Painting may be said to become essentially decorative in its effect when a definite aerial and linear perspective viewpoint is abolished—that is to say, when from all points of view the beholder is primarily conscious of the painted surface; not of an illusion of things in space. The decorative painter paints the wall, he does not paint a hole in a wall. Many great artists have painted wonderfully interesting holes in walls; and, the better they have succeeded in doing so, the greater has been their failure as decorators. Puvis de Chavannes and Ivan Bilibin, after two or three centuries during which no western painter had even tried to paint a wall without priding himself on making a hole in it, have shown us two distinctly personal and characteristic ways of respecting surface. The Russian does not hesitate to borrow his colour schemes direct from Nature in all her moods. In him there is a great painter of landscape behind the still greater decorative painter. The Frenchman has a less catholic taste in colour schemes and relies on a subtle code of reduced and simplified colour values based on the blues. Neither ever forgets his wall. Both can be intensely dramatic, while yet confining their figures to attitudes of slow movement and suspended action. Any impression of rapid or violent movement is apt to defeat the flatness of the wall, unless conventionalized to the point of absurdity.

7. *Graphic Art*

Many pages have now been consumed on what is the mere A B C of drawing and painting. In that there is a right and wrong, or at least a better and worse, leading to the use of a didactic, sometimes a dogmatic, phraseology. In what follows there is no room for such an attitude. From here on it is not a question of spelling and grammar.

It has been made clear that drawings and paintings, whether well drawn and well painted or not, aim to be expressions of facts, or of fancies assembled out of facts. The draughtsman and the painter may go further as artists. When they do so, the integrity of the simple expression must suffer, in exchange for what the artist conveys of his emotional experience generated by the subject. The drawing and painting are matters of craftsmanship. The choice of subject is a matter of taste in which the graphic artist has vastly more direct liberty of action than the designer, dependent always on the co-operation of his client in carrying out work. The emotional experience conveyed by a work of graphic art is, in the first place, dependent on the artist's possession of it; in the second place, on his having the artistic impulse or temperament, which impels effort to communicate it; and thirdly, on his knowing how to use technical means to that end. Technique can be taught and learned and acquired with practice; or, at the least, it can be explained and apprehended; but the knowing how to use it for the communication of mood is a gift which none can teach, or learn from another. Of genius, viewed objectively, one may predicate much; no one has ever yet engendered it in another; it has often been nurtured and tended and stimulated, but never implanted. One may label it the eighth gift of the spirit and leave it at that.

Of artistic as distinct from expressional method in graphic art a little must now be said. That little is chiefly for the benefit of those who contemplate drawings and paintings with curiosity as well as delight.

First of all there is always selection and emphasis on what the artist finds characteristic; this means suppression, or neglect, or even elimination of what he deems of lesser or no importance. His judgement as to this may be uniquely original, or it may be biased by school and tradition. In any case, it is what he finds characteristic in the thing and in its appearance that he elucidates as artist. One may say, if one likes, that he reveals its beauty; but it is quite unnecessary to make use of this word, which involves a mental hop, step, and jump between the objective and the subjective, and sometimes a sword dance over cutting edges as well.

Occasionally an artist's main preoccupation is the display of his own dexterity or mannerism; one then has the *tour de force*—sacrifice of the quality of the thing expressed in the interest of expressional athleticism. Technical brilliancy easily becomes the enemy of sincerity and insight.

By what jugglery does the artist, after electing to deal with a part of the appearance of a thing, invest his presentation with the mood it has evoked? It is most unlikely that, if asked, he could say. Leaving out the things that matter least to him is, after all, a negative process; but it is a clearing of the ground for emphasis on what matters most in the characterization sought—a preparation for exaggeration. When this emphasis is carried too far there is caricature. The difference between graphic expression and graphic art rests very largely on selected emphasis.

But one must never forget that there could be no such thing as exchange of feeling between artists and those who contemplate their works without the fund of a common experience. The line, the light and shade, the colour scheme, are each a potent means to arouse a wealth of images, associations, and impressions which reinforce and enrich a thousandfold the poor figures and pigments displayed on paper or canvas or wall.

Suppose, for example, a passage in a picture representing a blue cloak worn by a lady—Mary Star of the Sea, or a peasant girl, or a yachtswoman. Whatever she be—the cloak is blown by the wind, the figure within the cloak contests the wind, and the folds take form from the wind, the figure, the poise of the figure, the cut of the cloth and its texture. The lines and the modifications of the local colour by light, shade, and shadow in a given illumination—by themselves mere matters of mechanical labour and observation—taken in their entirety give realization of things the artist saw, or imagined himself as seeing, with interest and delight. His chief preoccupation may be with the lady, with the wind, with the cut of the cloth; or in the colour of the cloak and in what happens to that colour under the light. He may perhaps be interested equally in all these things. The aim of his artistry is to give to others, in so far as they are competent, a like interest and a like delight. If they know nothing of wind, ladies, and cloaks, they can only see on the intercepting plane extension of figures diversely pigmented. If they know something about the mechanism of tracing lines and laying in colour, they may be content with that.

Those who profess to find a source of emotional inspiration in abstract arrangements of line or colour, as such, delude themselves. In a case where one is wholly ignorant of what the arrangement of line and colour signified to the artist, and thus unable to translate the line and colour into fact or fancy, one may yet derive something from their intrinsic qualities of grouping and arrangements; but only if they suggest something else that is indeed familiar—the kind of lines that occur in structures, animals, plants, or mountains; the kind of colours that occur in sea, sky, forest, or farm-yard.

The bit of blue cloak, untranslatable for him who never saw a cloak, blue or otherwise, may be drawn with lines suggestive of flowing water, and painted with colours reminiscent of the thunder cloud. The observer may be sensitive to the rhythm of water and the suspense of thunder clouds. Experiences and associations are the stuff of which graphic art is made. Line as line and colour as colour are impotent things.

XXVI

SCULPTURE

1. *The Sculptor's Limitations*

SCULPTURE, independent of decorative intention, remains to be dealt with. Much of what has been said with respect to decorative sculpture, when discussing ornament, and with respect to drawing, in the preceding chapter, has its obvious applications here. The concern is chiefly with human and animal form.

The position of the sculptor in face of his subject-matter is on all fours with that of the draughtsman and the painter. He deals with what may be called ready-made form; this he modifies as the spirit moves him. When he invents dragons, mermaids, centaurs, and angels, he reassembles elements out of his experience and designs. But he does not generally first evolve his raw form by a process of reasoning as the designer does, but begins his work with a knowledge of the form he is dealing with, and can proceed directly to make his commentary on it. The sculptor may, like the others, content himself with a simple expression of what is or might be; but he may also, like the others, go on to artistry. If so, like the architect, he relies on a fund of common experience, in those who behold his work, out of which to weave the spell of mood. Like him also, he is bound to respect his material and the technique it engenders.

The sculptor concerns himself with form in a more literal and direct sense than the draughtsman and the painter—their interest is in the appearance of form under given conditions of light. He does not take this evanescent incidence of light on his real or imaginary subject into consideration at all; though he may take some account of the light under which his own reconstruction of form will be seen.

Before proceeding further it may be useful to summarize, very briefly, how material affects impression. If it is dark in colour the figure—man or beast—will look thinner than it is, and detail may have to be forcibly modelled; if the material is light in colour the figure will look thicker and more massive than it is; if the stuff used has a shiny surface, then, even if dark, some high lights will be obtained by very slight modifications; if it is more or less transparent, more mass will be required to produce a given effect. Thus, to give the precise intended impression of the form of a nude human being, considerable differences would be required for renderings in dark polished bronze, in dull patinated bronze, in polished white marble, in plaster, or in buff sandstone.

Then the structural strength of the material also exercises some control; a hollow bronze casting of a figure may have its centre of gravity well out from its support. Stone or marble, on the other hand, demand actual stability and adequate mass.

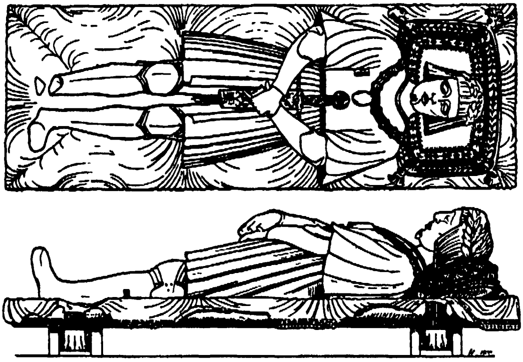

FIG. 168. Tomb of Gaston de Foix (d. 1548). Milan.

The process for the reduction of the material has to be taken into account; the difficulties of casting, the dangers of cutting, affect form. It does not follow, because almost any figure in almost any pose can be modelled in grey clay, or wax, on an armature, that the impression, when the form is reproduced in another material, will be the same; or indeed that such translation will be feasible.

2. *Movement*

Usually a sculptor is concerned with a figure in a static pose, or in suspended movement—one action just completed, another about to begin. How far will the conditions and circumstances under which the sculptor can reproduce form allow him to go in representing form in motion? Obviously he cannot make his angels fly, his men run, his dogs leap, without mechanism to that end. The moving picture is possible—witness the charming adventures of Mickey Mouse. It still remains more satisfying to see a dancer dance, an athlete run, a dog leap through a paper hoop, than to see a jointed statue strike a bell. One may rule mechanical movement out. But what remains? Suggestion of motion.

Instantaneous photography and slow-motion 'pictures' have made us all revise many of our ideas on the successive attitudes of horses in a race or athletes doing a pole jump. We are no longer content with horses everlastingly *ventre à terre* now that we all know that no horse ever adopts that attitude on the flat, and that, in the middle of a jump, his fore and hind legs are very rarely extended at the same time. Our predecessors were content with such things, generously assuming that artists were more observant than other men.

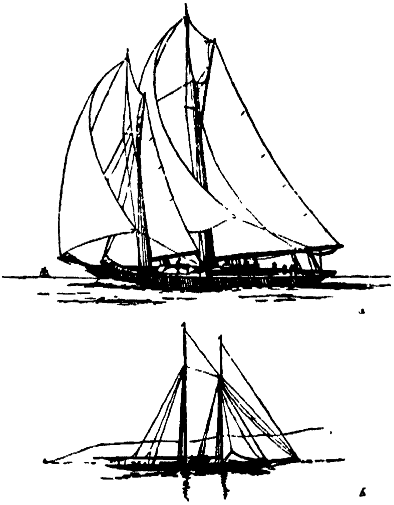

FIG. 169
a. A schooner under press of sail.
b. A schooner at anchor.

The argument that there is a flow of line, which suggests rapid movement, about a horse with legs extended fore and aft and belly twenty inches from the sod will not stand analysis. Movement in sculptured figures of men and animals can only be suggested by poise, or lack of balance, related to the direction of the movement; and by the representation of certain muscles in contraction and certain muscles in a state of relaxed tension, all with due regard to the positions of the joints.

The static form of a man, animal, vehicle, or ship, capable of rapid movement, presents no difficulties to the sculptor. A ship travelling under sail, if not the only thing that can be represented in motion, is at least the easiest. The form the wind generates in the sails is perfect indication (to those who have seen or journeyed in ships under sail) both of the direction and the speed. The heel of the vessel further helps; and the 'lines' of the hull give some hint both of speed and behaviour in a seaway. In the case of a more stable vehicle, however, movement can only be suggested by the addition of smoke left behind or dust raised, neither of which is very promising subject-matter for sculpture, due to the material difficulties. The conventional device of lines squirting backwards, a cheap artifice of the journalistic draughtsman of aeroplanes in flight, presents no temptation to the sculptor. But the form of a ship moving under sail gives clear indication of direction and speed.

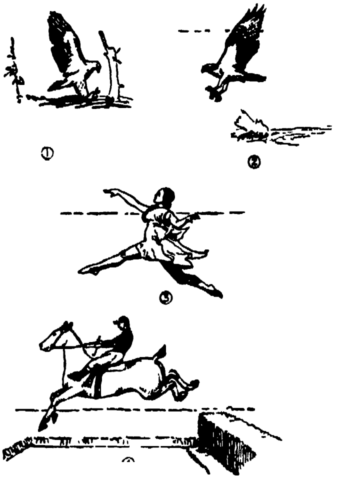

FIG. 170.
1. Eagle descending.
2. Eagle rising.
3. Child springing.
4. Horse jumping.
Position in action is not always expressive of direction.

Men and animals are not rigid when in motion, like steam-engines. Yet, unlike ships, they do not obligingly take a more or less static modification of normal form in explanation of the cause of motion (except when skating or sliding). But men and beasts do alter their balance when in motion, which gives the sculptor something to begin with; they also move their limbs, modifying the normal forms of the limbs in so doing; the limbs then, like sails in a blow, give expression of the immediate cause of motion. Hair and drapery, moreover, take modified form in obedience to the resistant air which has little or no effect on the more solid parts of the moving organism.

Then again, the motions of human beings are often undertaken for the guidance of an implement, or weapon, by movements that are common knowledge. Driving a scythe through wheat involves a different series of successive attitudes from bringing the implement back into position. The execution of a circling cut with a sabre involves a series of successive positions, none of which could be mistaken for the action of returning the weapon to its scabbard.

The sculptor who desires to recapture the impression of movement—without resort to a wholly arbitrary code of flow of line—has balance, attitude, muscular modification, resistance of the air to drapery, and implements in use, all available to aid him in doing so. Before he can make good use of any one of these, he must understand it thoroughly. He will usually have need of balance, attitude, and muscular modification, at the least. But, apart from the means available to him for the expression of movement, there is something else he must understand very thoroughly—the entire movement out of which he selects the instantaneous attitude.

Material considerations may exclude all but a few of the successive attitudes involved; but it is only by an appreciation of the whole movement that he can expect to select an attitude at once feasible and fully expressive. Rodin knew very well what he was doing when he made his models move about for long hours before his eyes, realizing that it was not the line that made the attitude expressive, but the attitude that made the line so.

3. *Characterization*

It will be more profitable at this stage to investigate the basis of character in the forms of man and beast directly in the raw material of sculpture than in the sculptor's reproductions. We must seek to distinguish between what is typically characteristic and what is individually characteristic. The sculptor cannot emphasize either, except at the expense of the other.

The notion, with which so many sculptors have toyed, of a general ideal proportioning of the structure of man is utterly foreign to the views on form to which these pages are dedicated. Among the several racial types there is no better or worse; to survive in a given environment is a matter of purpose; to be subjected to a given environment is to submit to a process. Form may thus be modified, but the stuff that men are made of remains all but constant. Objectively regarded, form is always explainable. Interest in any particular variation of human form is partly a matter of past experience and partly a question of appreciation of specialized function. Men and women, within all races, find loveliness in each other without respect to a general canon of form. The attraction of the unusual makes up the small balance of interest; this gives the foreign lover his occasional chance. Human beauty, our interest in the physical characteristics of other people, may be put down as 90 per cent. recognition of type, 9 per cent. appreciation of quality within the type, and 1 per cent. attraction by idiosyncrasy. There are and can be no absolute, or general, standards. Racial pride and racial animosities both tend to promote actual differentiation and to the establishment of standards based on group characteristics.

Within each racial type there is the modification of sex and age. The diverse proportions of the several parts of men and women are expressions of functional differentiation. The proportions of the several parts—limbs, head, body—in both sexes, also vary in childhood, youth, prime, and age. Thus, without taking quality or idiosyncrasy into consideration one has to reckon with racial type, sex type, and age type. Quality may be broadly defined as the expression of health. What is called the physical beauty of an aristocracy, or a peasantry, is the result of generations of breeding of healthy persons and of the facilities available for persons so bred to remain healthy. Urban industrial populations have hitherto degenerated towards extinction, notwithstanding their fecundity. Now hygienic science and social responsibility are combining to arrest this process of extinction. It remains to be seen whether the restoration of physique will follow.

Group idiosyncrasy, within a racial type, is a matter of specialization to certain labour and exercise for generations—breeding for speed, for concentrated effort, or for endurance. The individual can modify his physique by assiduous devotion to a special sport or occupation; but such specialization is usually chosen out of deference to already inherited physical characteristics. Individual idiosyncrasy, which science seeks to explain by the investigation of hormones and genes, one may well be content to refer to nature's ingenuity in trying out new designs made up from old ones. A girl may thus chance to have larger eyes, or a smaller mouth, a boy may have longer legs, or broader shoulders, than any other girl or boy in the village. The idiosyncrasy attracts attention; and, if it is judged a useful idiosyncrasy, it is valued and admired. In any case, it is an individual characteristic.

4. *The Features*

Such, roughly, is the stuff of which physical characteristics in men, and beasts also, are made up. On this the poets and novelists have built up a pseudo-science of the features which professes, infallibly, to relate physical to mental characteristics. Thus a large chin becomes the sure sign of a determined character; plump lips are supposed to signify a sensuous disposition, while long 'monkey' hands are accepted as an indication of artistic proclivities, and so on; always with the implied assumption that a specific form of feature or limb carries with it a specific mental or moral quality. Now a few visits to a national portrait gallery and some acquaintance with historical biography is all that is necessary to explode such superstitions.

In so far as races vary in facial and bodily characteristics and, through the accidents of their history and cultural development, have developed certain general habits of mind and certain ethical standards, there is a slender basis for associating certain types of humanity with certain kinds of behaviour. Science may explain the type and science may explain the behaviour, but science can make no pretension to establish causal relations between Armenian noses and Armenian business instincts. Police evidence, and not the shape of a man's ears, is happily still the basis on which jail sentences are meted out; and seems likely to continue so. In a population of mixed origins, such as that of the British Isles, there is abundant opportunity for observing variety of physiognomy. Perhaps that is one of the reasons why English literature is so plentifully besprinkled with false deductions as to mental qualities based on the relative size of an eye, a nose, or a jaw. One may prognosticate the behaviour of a schooner from the cut of her jib, but the profile of a man has nothing to do with the course he will take under stress of circumstances.

Now conventions, however unscientific and unhistorical in their basis, are the very life blood of the minor novelists, minor poets, minor painters, and minor sculptors. It is given to few to look reality in the face. So it comes about that sculptors not infrequently subscribe to this code of artificially propagated associations between the outer and the inner man. There is much of the old medieval 'bestiary' clinging about this code. The man who looks like a lion, even if it be but due to the way he cuts and dresses his hair, is supposed to have the wholly imaginary nobility of character ascribed time out of mind to that rather stupid representative of the larger cats. The man who looks like an eagle is supposed to have a soul that soars aloft above mundane affairs, and an eye that penetrates to the heart of things, through time as well as space. If he is disliked by the writer, then he is said to look like a vulture, and is put under suspicion of battening sordidly on last wills and testaments.

Zoological characterization has no limits. The fox, the bulldog, the rat, the dove, the cod, the cow, the snake, each have their characters torn to pieces to accord with some very biased account of their lives and work; the remnants are then hung about the heads of perfectly innocuous people who chance to possess comparatively sharp noses, wrinkled jowls, bright eyes, plump necks, large mouths, immobile faces, or svelte bodies. Historical personages whose features have been recorded faithfully, and regarding whose characters there are usually two views, have all-unconsciously provided many a symbol of this code. A lady, in real life, who looks like Queen Elizabeth suffers some suspicions as to her sincerity. A lady in a novel who behaves like Queen Elizabeth is made to look like her. Meanwhile all the virtues are accorded to young women with what are called regular features—an example of man's incurable optimism; an aspiration that the well-bred and physically fit would prove mentally and morally congenial and wear well.

When in 1526 Albrecht Durer engraved a portrait of Philip of Spain, he inscribed it as follows:

'Viventis potuit Durerius ora Philippi,
mentem non potuit pingere docta manus.'

(Durer could paint the features of the living Philip, but his skilled hand could not paint his mind.) It is amusing to speculate whether this artist, a master of characterization, was paying a compliment to Philip's inscrutability, or simply stating that features are no guide to character. If the latter, he precisely summarized the position here taken so far as features of any particular type, size, or shape are concerned. That many of us, the writer included, are profoundly prejudiced against persons endowed with certain casts of countenance, and in favour of others with different types of features, is of course undeniable; but we must not mistake our individual prejudices for natural laws, or expect others to share them.

5. *Attitude of Mind and Body*

Turning from the normal, natural form of the individual to the consideration of his attitudes, gestures, actions, and the movements of his face, and giving attention to those changes in the face which come about through habitual movements, one does indeed find something solid on which to construct a code, based on the revelation of the inner man through the temporary and permanent forms which his body assumes.

The position of the body and limbs of any creature at any moment is indicative of a pose of rest, or of a movement completed, or of one about to be begun, or of a phase in an incompleted movement. Every position is thus significant of some mental state. The contortion of facial muscles, static or in process of change (momentary 'expression' of the face) is yet more directly and powerfully suggestive of the mood and emotional experience of the creature.

There is really no need to distinguish between attitude of the body and 'expression' of the face. In essence and origin they are one and the same thing. The smile is but a modification of the grin, the grin originates in a baring of the teeth preparatory to the mastication of food, a symptom of agreeable anticipation. Preparation to fight is evinced by the set-jawed snarl of rage, accompanied by the nervous tension of the moment before the battle is joined 'with such weapons as God has given'. All moods are reflected in the face (English public-school standard of deportment notwithstanding), but the fact that most of us wear clothes blinds us to the fact that the limbs and trunk of the body are likewise highly sensitive.

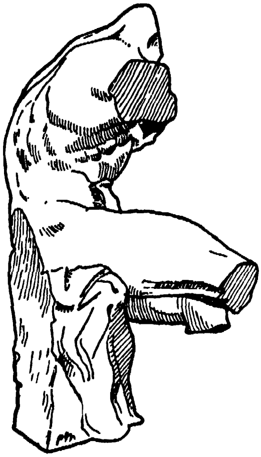

FIG. 171.

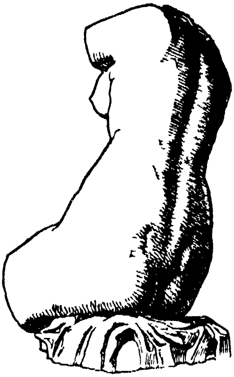

FIG. 172.

FIG. 171. The Heracles Belvedere, Rome. (The muscular tensions suggest struggle.)

FIG. 172. A Venus.
(Note the delicate modelling of the lower back.)

But what of those marks which the vicissitudes of life co-operating with disposition—itself the product of heredity and environment—stamp upon the face, and on the body as well? In these marks, which time puts upon us, there is indeed a code—but it is far from conventional. The extent of our joys and sorrows, the mood in which we have met them, their very nature and ours, come, by habitual contortion of facial and bodily muscles, to imprint upon us signs of what we have indeed become. That is why portraiture of middle life and age is so much more interesting, if far less charming, than portraiture of childhood and youth. The hard and the soft life, the strenuous and the easy life, the bitter and the sweet life, may, any of them, make or mar us, and in the process leave upon us inevitable records, not of what life has been to us, but of what it has done to us. When the sculptor's insight leads him to use pose, gesture, attitude, movement, momentary facial contortion, and, above and beyond all, acquired facial 'expression' to reflect the spirit of his re-creations, he enlarges his subject far beyond the confines of a mere analytical reproduction of the normal form. He then deals with life, always a far more subtle and interesting thing than the envelopes, however wonderful, in which life is enshrined.

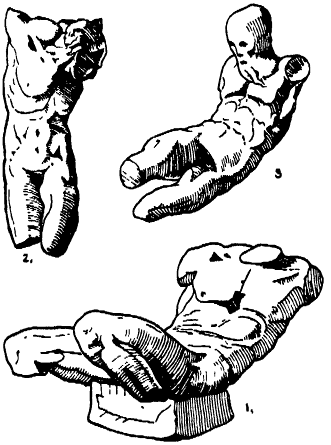

FIG. 173. Three small wax models from the hand of Michelangelo.
1. A study from life.
2, 3. Compositions based on 1.

6. *The Sculptor's Art*

The sculptor's art really begins where knowledge of the forms he is dealing with ends. To reproduce, on whatever scale, the form of a personage, or an animal, or of a composite creature of his imagination, made up from elements of persons and animals, is a worthy enough accomplishment of mechanical expression; but it is not art.

Now there exist, in one of the Florentine collections, three recently discovered wax models from the hand of Michelangelo (of these the writer is so fortunate as to possess plaster casts, gracefully bestowed upon him after he had appreciated the originals). Comment on these may serve a double purpose: to throw some additional light on what we already know of that great master's procedure when making sketch models in the round, both for his paintings and for his sculptures; and to make the point just now at issue clear. The largest is obviously a study from the life, oddly enough in almost the pose of the figure from the Parthenon usually called the 'Ilissus'—a reclining figure with a slightly twisted body. The study stops at the knees and lacks both head and arms. The other two wax models, to a somewhat smaller scale, are, as obviously, not studied from the life; but were evidently made with the study from the life, just described, either before the sculptor, or fresh in his mind. They have heads but no arms and also stop at the knee. The one is a sketch for one of the Malefactors in the Sistine Chapel fresco; the other a sketch for the figure of 'Dawn'—in the Sacristy of San Lorenzo in Florence. In both these sketch models the bend of the spine, the twist of the body, and the creases across the abdomen are very much as in the life study; but more physical development is indicated and the characteristically Michelangellesque liberties with muscular fact are in evidence.

Michelangelo's very original conventional presentation of muscular phenomena may be compared with certain tricks of Pheidias, when, following the practice of his day, he ignored the clavicle and insisted on tension in all knees, no matter how posed. Such liberties could in neither case be due to lack of knowledge, one may be sure, and are to that extent justifiable. In these sketch statuettes we see the sculptor laboriously acquiring such a knowledge of his form that he can proceed to use this knowledge as the raw material of his composition. Once Michelangelo knew enough, and it was a great deal, as the study from the life shows, about the human body in a certain pose of curvature and torsion, he could create his 'Malefactor' and his 'Dawn' based upon that knowledge without recourse to the hampering use of a live model.

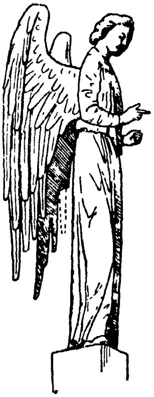

FIG. 174.

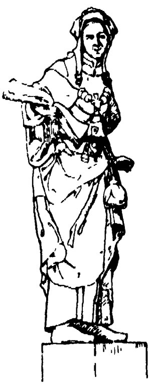

FIG. 175.

FIG. 174. Bronze finial about 5 ft. high, 1475. (Jean Barbet de Lion.) Original situation unknown. Pierpont Morgan Collection.

FIG. 175. Sibil. Tomb of Philibert le Beau. Early sixteenth century. Church of Brou, Bourg, France.

The sculptor's raw material embraces as we saw the general form of man or beast, the type, the signs of age, sex, native idiosyncrasy, individuality, attitude, and facial contortion. He need not use all of this raw material at his disposal; and he may include adjuncts to his heart's content. But he must know his raw material, be possessed of it, before he can use it; he is in the same position as the architect who must be possessed of the raw material of his solved problem before he can begin to suppress, or eliminate, what matters least to him and emphasize and exaggerate what matters most to him in his emotional comment upon it.

Much sculpture never gets, or seeks to get, beyond statement of form; but when sculpture makes use of form, and life in form, to evoke mood the prime interest is the mood. Verisimilitude then becomes a subordinate affair. It is then not merely a question of what is; but of how the artist feels about what is. The artist is employed on the strength of his ability to comment—on his possession of style.

7. *Review of Sculpture*

In conclusion a very brief review may be made of the sculpture of the last two thousand years, confining the remarks to those schools which are in the line of our tradition. Only at intervals has the making of graven images aspired to conscious artistic effort; and, within these limited periods, only a few masters have possessed the knowledge, the skill, and the spiritual force requisite for preeminent achievement. It takes a tradition to make a school, and a school to make a master. Among the few great masters one must place the unknown Egyptian who conceived the portrait of Queen Nefertiti. The long previous story of Egyptian sculpture is now at last endowed with point and interest. What happened afterwards is but the record of a decline.

Greek sculpture was long content with the conventional archaic smile, while generation after generation sought for the expression of anatomy, drapery, and coiffure in stone. Ultimately the great schools emerged culminating, let us say, in Polycleitus or in Praxiteles if you will. Now the Greeks, unlike most of the barbarians around them, had no prurient inhibitions with respect to nudity. Artist and public alike knew the human body at its best in an athletic aristocracy and in a hard-worked, well-nourished slave population. The pose that could be interpreted at a distance, and equally well in any view, was relied on for animation. Neither characterization nor contortion in the face were attempted. A well-bred type of physiognomy and a serenity of countenance was regarded as all-sufficient; so facial expression was never allowed to compete with attitude; and attitude was posed or poised. In the later Hellenistic school violence and stress were delighted in. Facial contortion becomes forced and over-dramatic, while resisted effort, rather than movement, is represented in the body and limbs. The glorious Samothracean Victory is poised. It is the ship that bears her that is in motion, causing the draperies to press and flutter in the wind; but the Hercules in the Vatican sits arrested in a strained fatigue. So with the Laocoön group—struggle without movement.

This group is marred by the preoccupation of the Greek school with the proportions of adult man. The boys are not boys at all, but little men, just as the children of the superb Niobe are little women; just as the columns of the Propylaea porches are little editions of the columns of the main portico.

The last phase of classic sculpture shows a complete change of interest towards realism in portraiture. This need not be regarded as a reaction from the older idealism or from the more recent exaggeration of the dramatic. That reaction did manifest itself in a pseudo-archaic movement which had a sobering effect on taste, no doubt.

The Greco-Roman portraiture seeks the truth of individuality; but a broad truth of simple handling with a good deal of convention in matters of detail. The facial expression is patently characteristic; but never momentary. A Roman lady smiles—she is not caught smiling.

Then came the decline, preceding by centuries the dissolution of the Roman Empire; in this catastrophe the very technique of sculpture was lost.

The sculptor's art was slowly learned again, and by the thirteenth century the knowledge and the skill had been acquired anew in the many schools that arose in western Europe. Now Gothic sculpture was rarely independent of decorative considerations; but it is not difficult to make a case, from the subordination of the immediately surrounding architecture, for many an individual figure and group to claim recognition as independent sculpture. In its way, which was a very different way from that of the Greeks, much Gothic figure sculpture is not inferior either to the best of that which went before, or of what came after. But how changed was the interest. A dominant celibate clergy saw little of divinity in the nude; and the artists' public were well clothed against the weather of northern and western Europe. Characterization by facial features and by dress thus absorbed attention and the anatomy of the body and limbs was ignored, except in so far as it was the framework on which drapery was carried. Type was investigated with an eye for discrimination; not for generalization. The figures of the advanced Gothic period are all portraits—Jacques or Bill, Marianne or Jenny—you can find their descendants within a mile of their stone ancestors. The lady on the corbel at Beverley has served the writer with beer, commenting on the weather in broad East Yorks with the exact same demure smile that the sculptor gave her. Three of the writer's stone friends from the porches of Amiens he has met in the life, within sight of the Cathedral towers—one, a prophet, fishing from a barge; one, a warrior, on furlough in horizon blue; and one, a crowned king, digging potatoes. The Gothic school in France reached to the zenith of its glory in the sculptures at Amiens; while in England the unnamed sculptor, whoever he was, who carved the corbels at Patrington, might have achieved a place among the immortals, given the opportunity.

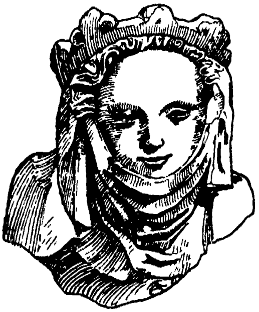

FIG. 176. A corbel in the aisle, Beverley Minster.

The early Italian school, based far more upon the medieval than upon the antique but deriving inspiration from both sources in its early stages, soon began to interest itself in dramatic gesture and facial animation superimposed on individual physiognomies. The Gothic interest in different kinds of men, surviving for a while in Italian art, gave way later on to a selective emphasis on type. But Italian sculpture never sought the broad generalization to which the Greeks had so readily yielded under the narrowing conception of a 'canon of beauty'. The spirit of the earlier Italian school culminates in the works of Donatello, to whom all subsequent sculpture owes a debt that can hardly be over-estimated—a master of masters. Later came Michelangelo with his *terribilita*, alone, unique, supreme, brewing a heady potion of which no follower has ever drunk except to his destruction—the very instrument of the decline.

The post-Renaissance phase of sculpture belongs pre-eminently to France. From Goujon, inheriting something of the traditions of all the schools above mentioned, and setting modern sculpture on its way, right on to Rodin—realist always in subject, idealist ever in content—France has produced a long succession of masters. If an expression of personal taste and appraisal may here be permitted, a place might be accorded above them all to this Jean Goujon, who flourished in the middle half of the sixteenth century. His work says so much that had never been said before, it implies so much that has been elaborated upon since and, great as was his debt to tradition, he never sought to recapture a spirit that was already dead. Always a Frenchman of his day, he was in time the first, and in many ways holds his place as the greatest, of the moderns, just as one may place Donatello last and in all ways the greatest of the medievals.

After what has been in Egypt, in Greece, in England, in Italy, and in France up till the other day, it is surely allowable to evince some impatience with those who insult our intelligence by waxing ecstatic over the infantile incompetencies of Hindoo and African sculpture; and, worse still, the revolting travesties of such ethnographic phenomena perpetrated by European morons. These seek to usurp the sculptor's place in our day with their 'brute mishandled' grotesqueries.

Modernistic sculpture, as distinct from modern, is but a futile compromise between decorative archaism and primitive gropings after form, and need not detain us. Enough has been said above to show that great achievement has never yet come about, except by a long-drawn-out process of relating technique to experiment. There has been a three-thousand-year general progressive development of the often interrupted Western tradition, through attitude and facial expression towards a sense of movement. Movement may have little or no place in decorative sculpture, but one must acknowledge the success of its exploitation in free sculpture. There is no reason for throwing all in the discard and beginning again by a feeble imitation of the so-called art of savages—the hardly articulate lispings of degenerate or undeveloped intelligences. The critics of the last two decades have much to answer for.

XXVII

THE CRITICAL APPRECIATION OF FORM

1. *The Critic's Function*

MANY people cannot apprehend either form or colour, as manifest in nature and in their artificial surroundings, unless set before them through the medium of graphic art or photography. Such usually prefer an oil painting as the intermediary instrument. They can only really see indirectly; and can be relied on to take more interest in a picture on a wall than in a view from a window. If they attend a football match, a horse-race, or a stage play, they may exercise good judgement of football, horse-flesh, or dramatic situations, but the spectacle, as such, leaves them cold. But let them contemplate the spirit of a match, a race, or a play, in extract, projected on a plane (a cinema screen will do), and they glow. For one of these his grandmother remains just his grandmother, till some competent artist paints her portrait: then she becomes the 'grand old lady'. That kind of person is apt to rave over the works of Peter de Hooch, which are well worth raving over; but he can see nothing interesting in the interiors which other Dutchmen of his time devised for Peter's delight. But some do learn to see things after they have seen pictures of them. Painters and draughtsmen learn to see still more through exercise in depiction.

And just as some require the intervention of the painter before they can see and feel, so others require the intervention of the critic who offers his verbal translation, however inadequate, before they can apprehend anything worth while as to works of art they might contemplate directly any day in the year. It is a function of critical appreciation to minister especially to the needs of such underprivileged children of misfortune, and to afford them a blink of the spiritual life reflected 'as in a glass darkly'. Now students of art are very generally regarded as in this underprivileged state: many regard themselves as so; some quite erroneously.

2. *Critical Method*

It is no part of the intention, in this chapter, to advise literary exponents of the appreciation of things seen as to their business.

The following remarks are addressed solely to those who have recourse to their writings, that they may be in the better position to derive the more profit therefrom, where profit is derivable.

The impossibility of completely translating artistic impression from one medium to another must be kept in mind. Words, however fairly used, must fall far short of conveying to another what the sight of a thing conveyed to him who writes or speaks of it. Drawing—itself a purely mechanical activity, no matter how skilful—may come near to sufficiency, but words fall far short. The critical appreciation is itself a new expression which may possibly be a work of art. Critical appreciation of music rarely attempts the impossible task of reconstructing musical impression out of words, contenting itself for the most part with revival in memory. But, because a thing seen can be very fully described in words, and can also be very fully described in drawing, there is a temptation to regard the impressions derivable from these two kinds of description as far more nearly interchangeable than they can possibly be. Because of such limitations, one must not infer that critical appreciation of form is impotent. It can be both potent and stimulating.

It is important that the reader of critical appreciations of things seen should watch the tactics of his author and try to keep aware, all the time he is reading, of what the author is at. Is he describing a thing he sees or has seen; describing his impressions and feelings on seeing it; describing the impressions and feelings he thinks he ought to have experienced; or describing those he thinks the reader ought to experience? Is he conveying information on the technique the artist has employed; on the subject-matter on which the artist's work is based; or asserting relations between the technique and the impression, between the technique and the subject-matter, between the subject-matter and the impression? Is he theorizing at large, saying he likes it, saying why he likes it, just begging the question and calling it beautiful, or implying that all who do not agree with him that it is beautiful have bad taste?

Now even the best and most fascinatingly readable exponents of critical appreciation show extraordinary versatility in changing their tactics half a dozen times on a page and often twice within a sentence. Whether it is the case of a monograph on a monolith, or a dissertation on all the stones of Venice, this illusive 'ring craft' has usually to be reckoned with as part of the game.

Critical appreciation, from the nature of things, is indulged in with zeal. The critic inevitably sets out to convert to his view, to infect with his emotion, to justify his taste. Like all 'bonny fechters' with their blood up, he dissembles intuitively and unconsciously just when his reader least expects it. The reader must, on his side, spar with caution and use his head so as to accept only those blows to the heart that come straight with undeniable force; and not be caught with deceptions that leave him parrying thin air while points are scored that should not have got home.

By way of warning the reader of critical appreciations to be on his guard as to what the critic might be at, an alarming series of questions was formulated touching his tactics. These are far from constituting an exhaustive list. It would not be difficult to exemplify each and all of these tactical schemes, showing at the same time that some of the more popular among them are founded in fallacy. These exercises may be left to the reader.

3. *The Scope*

It is now time to confine the field of critical appreciation of form within the limits appropriate to a discourse on design. The concern is not with the interpretation of abstract form; that, if it can be done, is for mathematics: nor yet with the interpretation of materialized manifestation of form in nature's animal, vegetable, and mineral kingdoms; that is for the natural sciences. What one has here to do with is the interpretation of certain of the activities of man, those involving the reduction of material to his service in the apparatus of life. These always involve expression and sometimes art. Critical appreciation of form, thus restricted, may concern itself with the expressional interpretation only. When there is art in the case, it may concern itself with both the expressional and the artistic interpretation; or with the artistic interpretation only.

Discussion may now proceed on the several matters on which the critical appreciation of a building may be expected to touch. If a building is selected rather than a ship, a vehicle, a piece of furniture, a garment, or a utensil, it is not because the same general elements are not involved in every one of these, but for the reason that, in a building, these elements are within the experience of most of the persons likely to read these pages.

4. *Appreciation of Plan*

First take the plan of the building—the entire functional disposition of parts, great and small, in space; not the plan in the narrower technical sense of disposition in the horizontal plane only. The plan may be a perfect expression, admirable in a thousand ways, a demonstration of the highest inspiration of skill and understanding, all without a jot or tittle of artistic activity about it. The solution of the problem may be regularly symmetrical, or irregular, and its being the one, or the other, may entail no artistic merit. Can art, in the sense defined in these pages, enter into the plan at all? Assuredly it can; but if it does, it is always with some sacrifice or detriment to the perfection of the expression as pure design; and usually with the intent to give emphasis to some characteristics of the plan itself. The vehicle of the art element may be a geometric regularity, or it may be an incidence of light and shade within the interior, or an abstracted simplification, or the dominance of the in some way important and the subordination of the somehow less important. The designer, become artist, loses some of his integrity as a purveyor of pure design, to balance the account in another medium of exchange. The great designer, when also a great artist, defaults but little, that he may pay back a hundredfold. *Il faut souffrir pour être belle* is but a quarter-truth. Art in design is not a question of an option between grace and solution; it is a matter of search for the graceful solution.

Critical appreciation applied to a plan may well exert itself to expound the solution and to evaluate the grace; but it does these things best when it recognizes their interdependence, yet without confusing the expressive efficiency of what is engineering with the expressional effectiveness of what is art—the clarity of pure design with the humanity of feeling.

5. *The Composition in Mass*

Now consider the composition as a whole in mass. The trite precept that 'the elevation should express the plan' is all very well as far as it goes. There is an implication here that the organic whole is not independent of the organs composing it. But there are usually, as already noted, good functional grounds for the envelope of a fish, or a boat, or a cottage, or a palace being more than a mere figure made up of the agglomerations of organic elements; for the exterior or envelope has its own special work to do. 'Should' here really means 'if organic relationships are involved must to some extent'. Broadly speaking, in medieval design there was an artistic interest or enthusiasm for the exposition of the organs, while in Italian Renaissance architecture there was a no less powerful artistic incentive to emphasize the characteristics of the envelope. The impulsive origins of these differences are revealed in the sorts of problems on which medieval and post-Renaissance architects found occasion to exercise their talents. The good critic takes cognizance of the nature of the enveloping form—of the degree to which it is functionally affected by considerations proper to itself. Where a critic weighs the sacrifices of engineering efficiency made in exchange for artistic effectiveness and appraises the latter, he should be listened to with respect. Even when one does not accept the balance of his accounting, it is apt to be illuminating.

As we have seen, the designer becomes artist when he regards the solution of his problem in terms of pure design as just so much raw material for composition—raw material which exercises a considerable control due to its own exigencies, but is yet plastic within limits. The architect does with his solved problem what the sculptor does with his living model—man or beast—he takes such liberties with it as he sees fit in the interest of characterization. It is open to the critic to deal with this manipulation and with the resultant impression; but he is likely to fall into error when he tries to do both at once by explaining content in terms of technique. This usually happens when the critic allows an interest in traditional forms to benumb his analytical powers—a matter on which more will have to be said.

In the manipulation of the raw material of the composition much account is taken of mass, because buildings are seen, and largely felt, as solid, notwithstanding their essential hollowness. Structural masses take the light, accept the shade and cast their shadows, just as if they were solid, thus opening the way to that exploitation of the geometrical characteristics of solid figures, on which architecture depends. The building may be simple or complex, symmetrical or irregular, long, short, tall, or squat, none of which characteristics is intrinsically either good or bad. If the artist makes use of the devices at his command to emphasize such characteristics, it is really nobody's business but his own. But the critic may properly see fit to comment on how the artist in the case makes use of scale and proportion in his manipulation; while he is doing this the critic is throwing no light on the mood of the thing; often he is obscuring it. An interest in the artistry is to be clearly distinguished from an ability to receive impression. The message in a telegram is lost to him who examines the script.

When the critic devotes himself to the appreciation of the impression of the composition as a whole, no artist can quarrel with him, for he is then entirely within his province. His impression may not be quite that of the artist, or of another critic, or of his reader, but its statement is authentic evidence that he finds something there; and circumstantial evidence that the artist put something there for him to find. This may be vastly helpful in opening the door for those who have not the courage to knock before they seek for themselves.

When Conrad gives his impressions of certain rows of houses in a street in Marseilles he is helping all who read the passage, whether they know that street or not, to understand what architectural impression is, and to realize it for themselves in other streets elsewhere and no matter how different the character or spirit of their architecture may be.

Nor does critical appreciation restrict itself to the spoken and written word. The painter who understands the spirit of a building and makes his graphic comments, as Canaletto, de Hooch, and Sir David Y. Cameron have so often delighted to do, is in precisely the same position as the writer of a critical appreciation who makes his interpretation. Both the writer and the painter, when dealing with a building, may call in the mood of the weather in a subservient capacity, or only make incidental use of the mood of the building; but in so far as they act as interpreters of the mood of the building, both are using the expressional facilities at their disposal in critical appreciation.

Those vehicles of expression which are capable of descriptive employment—notably speech, writing, drawing, and painting (and sculpture in a lesser degree), are to be clearly distinguished from architecture and dancing which are restricted absolutely within their own spheres. One cannot dance the impression of a building, or build the impression of a dance; each has its own field and its own garden. But, to a limited extent, and if one knows how, one may employ linguistic and graphic means to interpret what primarily subsists in any other modes of expression, whether in their broad fields of what is or might be, or in their tended gardens of the spirit.

How far music is restricted, like architecture and dancing, to its own field and garden has often been argued. Assuredly one cannot interpret architecture in music, the interpretive scope of which is certainly less than that of the linguistic and graphic media. In these the critical appreciation of form finds ready means of expression.

6. *The Elaboration*

It is with respect to the detail and minor parts of buildings that critical interpretation too often goes astray by deriving from such matters a basis for classification and statement as to what other building the building in question looks like, instead of describing how the building looks. When a critic, after scrutiny of the detail, blandly states that a building is in the style of some particular place and period, he is, as observed in an earlier chapter, misusing the word 'style'; but it may readily be granted that both he and his reader or hearer know quite well what he implies. He is then, first of all, assuming that his reader or hearer is cognizant of the practicalities and emotional values of the buildings of the time and place referred to. He is at the same time practically admitting that he cannot, or is too lazy to, put into words what these are. He is also quite likely revealing himself a victim of the fallacy of the artistic categories or classes. This sort of thing is not criticism; for the word 'style' so used is no criterion of value; it is convenient, if at all, in a purely descriptive sense—a good word to do without.

When the critic zealously points out the designer's plagiarisms or remarks on his traditional bias, what does he do? On the positive side, he is stating that the author of the design speaks architectural Greek, Latin, Middle English, Italian, French, or perhaps one of these with the accent of another. This is sometimes interesting, but it does not give enlightenment as to what the designer was architecturally saying, or was feeling when he said it. If the critic describes the 'style' as 'pure', he is just asseverating that the designer displayed erudition. When he adds words of praise, or blame, on account of this purity, the critic is saying something about himself, his views, his taste, his own erudition. This is no longer appreciation, but mere propaganda—perhaps sincere, probably venal, in any case to be treated with circumspection.

Should the critic see fit to comment on the impurity of the style, he is likely to be far more interesting. If he can point out the 'thousand originalities that are produced by defect of faculty for one produced by genius' he is doing a valuable service to artists and public alike. To maintain the just balance between tradition and innovation, the virtues of the old and new, to save mankind from that kind of originality which is mere ignorant quackery, to reveal that rare kind which comes down with fire from heaven—these are the sacred duties and privileges of the critic. To state that something is like something else, or like several other things, is not criticism, but may be science; and science has its place in relation to the arts. For critical appreciation, science and philosophy are absolutely necessary, but they must be kept in the background; it is fatal when they obtrude. The appreciation, if it is to be effective, must stand on its own foundations without shores and scaffold poles to mar its integrity.

Yet when the critic perceives an incongruity in the design of a building which he can account for as due to a mixture of undigested elements, derived without assimilation from the architectures of widely different periods, he may do well to display his archaeology. The essay in the grand manner contrived out of a row of houses at Murray Gardens, in Edinburgh, has been justly dealt with by a telling three-word blow—'Paestum and window-sashes'. For the writer of these pages it is the Doric colonnade and not the window-sashes that demands amelioration. He does not quarrel with the forceful ponderosity—that was the designer's affair; but he feels that the designer could and should have achieved this without a misapplied quotation, two hundred yards long, in a Greek Colonial dialect.

It is, however, no fault in Norman Shaw's Scotland Yard that his composition comprises windows of types evolved at various times over a period of two hundred and fifty years. It is a great merit that these do occur where each kind is most serviceable. It is an astounding technical achievement that they are all reconciled by their scale and proportionings to take their several places with perfect harmony: this reconciliation is further brought about by the congruity of the detail, which is always firm, clear, rational, and instinct with a bold grace. Consistency with tradition is the last thing to look for in Shaw's work. Consistency of mood and humour, and a serene, vitally strong spirit, as of energy controlled by gentleness, is written large all over the building to break out exuberantly at last against the sky at the tops of great gables.

The critic does good service when he exploits the real spirit of a design, even where his taste impels him to express his detestation. But the critic who merely explores origins, and stops there, only advertises his inability to realize that design is inevitably evolutionary, and composition consists for the most part in assembling old elements in slightly new ways. The age of the elements is a matter of complete indifference. It is on their being brought and held together that their efficiency to express fact, and still more to convey impression, depends.

7. *The Ornament*

Now when the critic relinquishes his attentions to the fabric as a whole and the elaboration of the fabric and turns to the adornments and decorations of the fabric, he has a double task. The adornments have a certain independence, both in subject and in treatment; but always a measure of dependence on the fabric in both respects. The appreciation of ornament is thus a fourfold affair. It has been already remarked that the ornamentalist has a function essentially different from that of the designer of the fabric, even when they are happily united in one person. When these functions are not so united there is every reason to ascribe to each his due; but jointly. If the designer does not exercise due control on the ornamentalist, the design at least should do so. Otherwise there is no ornament—merely representative expressional activity of some order, high or low. The critic does well when he appraises separately the theme of ornament and decoration, the technical translation of the theme to material, the theme as related to the purpose of the fabric, and lastly the technical handling in relation to the fabric and its parts. Was there ever a more consistently marshalled theme of decorations than that embodied in the sculptures of the Parthenon? Was ever sculptor's art and skill of a higher order requisitioned for adornment? Was it ever so misused as in its application to the cella frieze? And what of the incongruity of the canopy work on the heads of the nave piers at Milan Cathedral and at St. Mary's, Beverley. Exquisite in themselves as all these things are, viewed as ornament they break down under one or other heading of the critical analysis just recommended.

Above all let the reader of appreciations of ornament beware of the critic who draws analogies with nature. There is neither ornament nor decoration in nature; only functional differentiation of form and colour with occasional resort to materials extraneous to the organism for purposes of camouflage or attractive advertisement. The bower bird is not an ornamentalist notwithstanding his preference for blue and his use of black pigment, nor is the magpie a connoisseur when he selects bright trinkets. The blossom does not adorn the tree, nor do the spots and coloured markings of its petals adorn the blossom. Form and colour in nature are matters of pure design, and therefore expressional, but their place is in the field outside the enclosure that guards the magic garden of art.

Volitional expression on the part of animals is far commoner than is generally supposed; hysteria, the search for sympathy, is not unknown even among the cold-blooded ones; the birds and beasts and fishes evince skill, and delighted skill, in their hunting, their fighting, their building, and their play; but the interchange of emotional experience through 'physical aids' is reserved to man, the animal with tools. Yet not to all men.

The designer, when, in his pride of the thing he has conceived, he causes it to prate of itself, and the ornamentalist, when he enlarges on the relation of the designed object to men in particular and to things in general, are among those, the artists, who offer their wares in this traffic of the heart.

But quite as great in his way is he who with singleness of purpose achieves perfection in pure design—the engineer—brother on the one hand to the gods of creation, and brother on the other to fish that trench the gravel on the redds, to birds that fabricate their nests, and to beasts that turn round and round to make their beds in the long grass. The engineer, without trying to be an artist at all, may be only a little lower than the angels, but is more than a little higher than the beasts.

Skill in pure design is not art. When of a very high order it is sometimes foolishly mistaken for art of a low order. Pure design and art are different things, each to be judged and appreciated by its own standards. Even when the critic does not realize this, those who do, when they listen to him, or read his works, may often derive much benefit from his appreciations of form. His findings are often valid, even when his argument is fallacious through failure to clearly distinguish between the form that is perfect, or nearly so, as a synthesis of direct purpose, material, and technique, and the form, less perfect, because of an incrustation of forms in which the element of purpose is not direct, but dependent on the main fabric. Such dependent form comes within two categories——architecture and ornament.

The engineer discovers pure form. The architect as engineer also discovers pure form, but then as artist proceeds pridefully to elucidate the fact that he has done so, thus detracting from its purity but adding the elucidation. The ornamentalist superimposes a further elucidation directed, not at the form, but at the thing as part of the apparatus of human life.

In endeavouring to deal fairly by the engineer there should be no regrets in subordinating that part of the architect's work that is not engineering to that part that is such. But the artist, what shall be said of him?—fool, madman, lover, parasitic growth upon the body politic; that has all been said a thousand times; it has been given to Mr. Kipling to say it far better than most on three occasions, but best of all in the verses entitled 'To the True Romance'. To his statement there seems nothing to add.

XXVIII

CONCLUSION

1. *Summary*

AN aesthetic has been enunciated for which some merits may be claimed: it is made up out of old stuff; it seeks to reconcile long-standing difficulties; it avoids the creation of new ones. While accepting the identity of aesthetic activity with general linguistic, it goes far beyond what the coiner of that famous phrase admits. For this aesthetic, expression is universal in nature, of which man and his activities are a part. But it makes a sharp distinction between the expression that is found universal in design, wherever manifest, and the artistic activity of man which is expression restricted to the phenomena of his state of mind or mood. Nature is always an engineer; man is also an engineer, a discoverer of form in word and deed; but man can be an artist too—yet never independently of the engineer in him. He can only 'express himself', to use a trite phrase, when expressing something quite extraneous to himself as well.

Croce's schematic diagram of the four steps of spiritual (or mental) activity can be left standing; but it seems necessary to extend the area of the lowest step till it becomes a very wide platform; his steps would then conform to the aesthetic here enunciated. On this wide platform carpets may be laid. The platform is expression, the carpeting is art. The platform has been investigated and the carpets as well. These carpets, we find, can only be trodden when unrolled upon the platform, of which they then become an integral part. The expression of emotion remains mere ejaculation, when unsupported by expressional exposition of something else. The carpet needs a floor, or, to use another simile, the garden is made on the field.

A statement on the phenomena of form and colour vision has been attempted; partly with a view to the bearings that form and colour have on the technique of expression and of artistry; and partly to release the later discussion of design from the hedonic bondage that results from that superficial view of vision which names it one of the old five senses, or of the ten new ones. Once vision is understood to be a mental synthesis, or form of knowledge, the way is open to an understanding of form in creation, in design, and in art.

The exposition of the sciences of art in the first part of this volume went little farther than to define their scope and to categorize their problems, in the hope of narrowing the gap to be bridged between theory and practice. In the second part of the book some preliminary scaffolding was set up for the bridging of this gap, by such as are concerned with the design of objects constituting the apparatus of life. Distinctions have been noted between pure design (engineering); and the artistic elaboration (architecture) of that form which pure design discovers; and the adornment of objects once their form, pure or elaborated, has been established (ornament). The intention throughout in dealing with these matters has been to make clear what we do as engineers, what we do as architects, and what we do as ornamentalists; also why we act in these several capacities.

In the third part of the book the mental process of discovering pure form has been described by the consideration of a series of progressively complicated problems of accommodation. These seven chapters have furnished a detailed proof of the main thesis on which the aesthetic put forward is founded. They serve to demonstrate that the discovery of pure form is expression, but not art; thus they prepare the way for the consideration of such loss of purity in the form as may be compensated for by its artistic elaboration, or by the incorporation with it of extraneous subject-matter by way of adornment.

We thus arrived at the last part of this treatise, duly prepared to regard form—the synthesis of purpose, material, and technique—as the raw material of art, both in the case where the artist is himself put to the pain of discovering form, and where he is in a position to draw on the bountiful supply of all creation for raw material. The positions of the architect, of the painter, and of the sculptor, in their several traffickings and dealings with form, are all found to be analogous and in harmony with what had been said in the opening chapters with respect to the artistic impulse.

It may well be that, in the discussion of the critical appreciation of form, a certain impatience has been shown with those whose philosophies of art are based on an experience far different from the writer's. This defect of temper may have left the impression that critical appreciation of form is not as valuable and important as the writer actually regards it to be. A public, insensitive to form, will provide itself with an apparatus of life in which the designer-artist can have neither responsibility nor opportunity. Those residues of past experience on which taste is so largely founded then become vitiated, and the foundations of culture suffer deterioration. A spirit of critical appreciation must be kept alive for the general good.

2. *Tradition*

Intelligent appreciation of form has a most important place in the mental equipment of the designer who aspires to be artist. Without it the heritage of the past can only be a source of confusion to him, and he is left to choose between becoming a 'style-monger' on the one hand, or a primitive experimentalist on the other. The designer with a well-developed critical sense is not likely to be content to devote his energies either to archaeological reconstructions, or to meaningless novelties. His critical faculty should enable him to derive from the old those eternal principles that apply to the new. He may then realize that the construction of a replica of an Athenian Doric temple is a fatuous way to memorialize a dead president of the United States of America; and repudiate a replica of a Tudor dining-hall—with wainscot, mullions, hammer-beams, and all—as mere stage setting when it finds embodiment in a modern educational institution in the western world.

A critical appreciation of form, that enables one to separate the wheat of reality from the chaff of incongruity, can further be relied on to indoctrinate an evolutionary instinct. This enables the designer to discriminate between the old expression that cannot be improved upon, and the new expression, when there is need of it; between the matter in which tradition is available to help, and the matter in which tradition must be discarded lest it hinder. This faculty of analysing purpose, material, and technique and acting in accordance with the analysis is at the root of all progress in design. When the designer seeks to analyse the old problem with the same vigour that he applies in his analyses of the new, the old may on occasion be of great service. But we must come with fresh minds to the analysis of the old, ready at all times to put the pretty writing about it to the acid test, and 'prove all things' with such gifts as we come by or can acquire. An acquaintance with the methods of zoology, botany, and biology will go far to equip the designer with an understanding of form in things made for a purpose.

No one who has persevered thus far can be in any doubt that the writer has not a jot of sympathy for the eighteenth-century conception of an absolute beauty—form so potent that it must compel appreciation. Throughout he has been quite content to substitute for an 'aesthetic ought' a mere 'aesthetic may'; and, further, he readily admits the phenomenon of a sincere appreciation lavishly accorded in many cases where there is no form at all, but only an illusion of its presence. The lack of observation that makes it possible to pass false coin is, however, not the affair of a mint master. His business is to see to it that true coin is issued. It is for the police to warn the unwary when false coin is uttered; and it is the function of the critic to warn the unobservant when design does not bear the stamp of reality. In the long run it makes little difference whether the police and the critics intervene; for the spurious, in either case, is always bound to be found out.

One may be all for realism, and yet have little patience with a make-believe realism which denies that reality has been found in the past. Tradition, duly sifted, is as potent a force in art to-day as ever it was. There can be no progress without it. It would require a cataclysm, that reduced six continents to a no man's land, to make a really new beginning possible. One must distinguish between modernistic absurdity and modern genius in design—the one denies the past, the other realizes the present as the step between the past and future.

FIG. 177. Church at Rhuis, near Compiègne, France.

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